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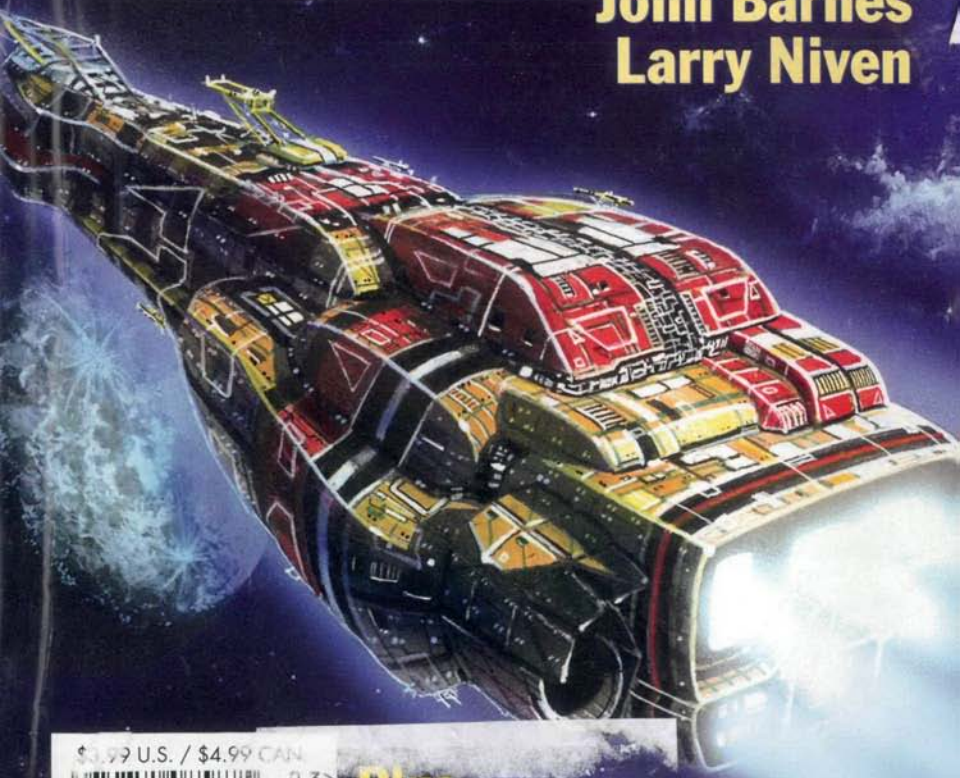

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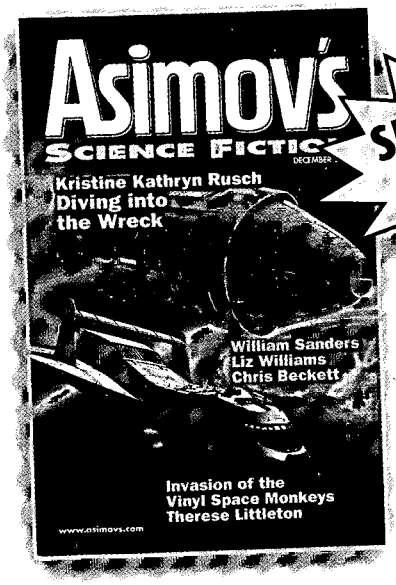

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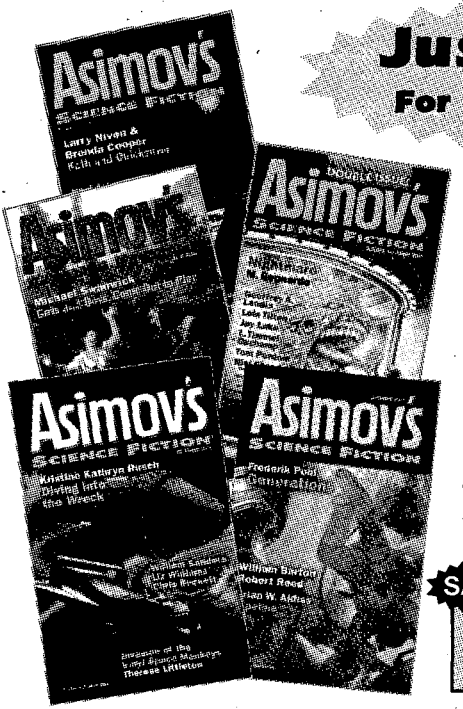

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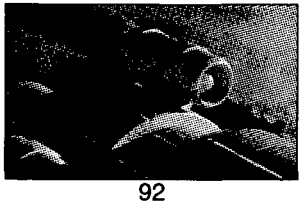

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EDITORIAL Stanley Schmidt

THE REAL AND THE READABLE

As you read this, a highly unusual medical drama series will probably be well into its second season on network television (or, depending on the moods of the fickle gods of ratings and network managers, relegated to history). My subject today is not that show *per se*, but it and some of the reactions I've heard to it make a good example for some general observations about creating fiction and drama.

House, in case you haven't seen it, is unusual (and rather *Analog*-ish in flavor) in that solving a difficult scientific mystery is a central element (but not the whole) of each episode's plot, and the details of that mystery are usually far more carefully researched than you might expect of network television. Dr. Gregory House (a spiritual descendant of Sherlock Holmes) is a cantankerous guy who likes solving really difficult cases—indeed, it's hard to get him to work on any other kind, because he won't bother unless he's really interested. He's been fortunate enough to find a job at a teaching hospital that lets him head up a department of diagnostic medicine, surrounded by several bright young residents. He is not a corporate team player, he has no bedside manner whatsoever, and he's perfectly willing to use unorthodox methods that skirt legality to get information he needs. The only reason anybody puts up with him is that he gets results: Usually (but not always) he and his team manage to solve medical cases that have baffled everyone else.

My wife and I happened to stumble onto the show from its very first installment, which is unusual for us. We don't watch much television, and seldom try new network shows until they've been around for a while and somebody we trust tells us that this or that is unusual in ways we'd like. In this case our curiosity was piqued by a feature story about the show before it started. So we tried it, and were immediately struck by the general sharpness of the writing (on a network not generally noted for that) and especially by the fact that the medical mysteries were genuinely complex and baffling and the details of their solution, in most cases where we could judge, were quite accurate. The number of cases where we could judge was pretty high: Joyce is a medical technologist with many years of clinical experience, and I've picked up a pretty good layman's smattering of medical knowledge from conversations with her and doctors I've worked with in other capacities (such as writing for *Analog*). When neither of us was sure offhand whether something said in the show made sense, we could easily consult one of the medical reference books in our library, and usually it did.

When we did have quibbles, they were usually minor and peripheral things, not too hard to overlook. In one episode, the investigators claimed New Jersey has three native species of poisonous snake; actually (unless one has drastically extended its range since my references were printed) it only has two. On several occasions, Joyce couldn't

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suppress her skepticism when doctors were shown doing their own lab work, since in her experience they almost never do and seldom even know how. But overall we were impressed by the level of medical thinking that had evidently gone into these shows, compared to what's usually seen on television; and we wondered what doctors thought of it.

Initially, the show attracted few watchers and generated little comment by critics. It eventually built a substantial following by the old television trick of being scheduled right after another show, much more popular (if pretty silly); more and more people found themselves watching a little, getting interested, and sticking around for the rest. And in July, the weekly science section of *The New York Times* (7/19/05) carried an essay about the show and reactions to it by a medical doctor named Sandeep Jauhar. He offered no complaint about its medical foundations; indeed, his essay concluded, "The show reminds me of the wonders of medicine. It allows me an hour each week to relish the magic and mysteries of my profession, even if it's only on TV."

Both he and his wife (also a doctor) did find certain aspects of the show "unrealistic," for different reasons. His wife, like Joyce, often said, "Doctors don't do that"—Joyce in reference to doctors doing their own lab work, Dr. Jauhar's wife in regard to individual doctors doing work that would normally be done by several different kinds of specialists. Dr. Jauhar saw it as unrealistic because, "It portrays a world where doctors have time to solve problems," and the rest of his essay is a sort of wistful lament for a world in which they usually don't. In our world, he says, doctors are under such intense pressures that few of them have time to put House-like effort into solving difficult cases, and it doesn't happen. Instead, questions are tossed out to consultants; the unspoken but hard-to-avoid corollary is that really difficult cases may not get solved at all. Dr. Jauhar sees *House* as unrealistic because real doctors wouldn't have time for its kind of sleuthing, but he likes watching it as a depiction of medicine as it should be rather than as it is.

They're both right, and the questions they raise, both practical and philosophical, are ones that bear periodic reexamination in connection with any kind of dramatic or fictional writing. For example, Dr. Jauhar makes two points: *House* is unrealistic, in that the doctors and work environment it shows are far from typical of the real world; but it's worth watching anyway because those characters and their setting generate highly interesting situations that might arise in a few rare real situations and in any case serve as a needed reminder of what *could* be. Those observations, I submit, are relevant to anyone trying to write drama or fiction.

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Readers and critics sometimes say they want their plays and stories to be "realistic," and sometimes they explicitly or implicitly use that word to mean "typical" of reality. In a medical show, for example, this might mean that they would want writers to avoid situations in which doctors have time to really delve into a difficult case, because real ones seldom do. But "typical" situations are seldom very interesting. Quite often what makes a situation interesting—able to hold a reader's or viewer's attention and make him or her think—is the way it's *atypical*. Dr. Jauhar is right that the biggest way in which *House* is atypical is that it features a doctor with an intense interest in solving hard cases and a work environment (which nobody denies is quite unusual) giving him the luxury of being able to do so.

There are other ways in which it's atypical, even unrealistic, too. House, for example, not infrequently uses the services of a resident with experience as a juvenile delinquent to surreptitiously gather crucial information about his patients' lives that they're unwilling to volunteer. Few doctors would dare risk that in reality; still fewer could get it away with it if their bosses found out. But the fact that House does it in his highly unorthodox way makes him far more interesting to watch or read about than a typical "realistic" doctor who rushes from patient to patient, spends far too much time on paperwork, and farms all the details out to unseen labs and specialists.

Readers and audiences don't *really* want realism, in the sense of fiction that faithfully mimics the commonest and therefore least interesting forms of reality. They want *verisimilitude*: the feeling that what they're watching *could* be real, no matter how atypical it might be.

And creating that feeling for readers and audiences also involves practical considerations and some necessary artistic license. Joyce and Dr. Jauhar's wife are quite right that real doctors seldom do their own lab work and tests involving different medical specialties will really be divided among a like number of different specialists. But if you tried to show that in a script, it would lead to a great proliferation of characters, making it hard for viewers to follow the action and requiring the producer to hire too many actors. The latter problem doesn't arise in prose narrative, but the problem of confusing the reader does. A storyteller is generally well advised to pare

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his or her cast down to a necessary minimum where every character is contributing something significant to the story. (But I can't resist an aside, directed at writers generally: Don't forget that there are stories surrounding those "backstage" characters, too, and sometimes it would be nice to see somebody like a medical technologist or a radiologist onstage and center. It's been done, but far too seldom.)

There's at least one more practical consideration that applies to "realism" in both drama and fiction. Not only are atypical cases more likely to be interesting than typical real ones, but a writer could seldom get away with describing *either* a typically dull or an interestingly atypical situation in a completely realistic manner—that is, as it most typically would happen in reality. If you ever pay close attention to almost any real conversation—what's actually said, not the edited gist that you remember it as—you'll notice that it's just full of awkward pauses, empty noises like "uh" and "like," grammatical awkwardnesses, and sentences tentatively begun and then restarted, sometimes three or four times before they're completed. Nobody wants to read that; nobody *will* read that. A fiction writer has to learn to write dialog that doesn't sound like *real* dialog, but rather like what readers want to *believe* is real dialog—smooth, rolling trippingly off the tongue, occasionally glittering with wit, but not so blindingly that readers find their attention drawn to the cleverness of the words instead of the significance of their meaning.

For several years fairly early in my tenure at *Analog* I had the privilege of working with a prolific and talented writer named Joseph H. Delaney, who is regrettably no longer with us. My first contact with Joe was a long letter from him as a reader, wishing that the handling of law in our stories could be as careful and rigorous as our handling of physical sciences. Since he was a trial lawyer, and he wrote a really good letter, I encouraged him to write his own stories of science fiction in which law figured prominently. He did, sometimes brilliantly; but first I had to convince him that you *cannot* write completely realistic courtroom scenes because nobody would be willing to slog through them. You have to streamline that kind of dialog, introducing necessary inaccuracies into the details for the sake of readability, but without introducing major ones such as types of interaction that simply wouldn't happen in reality. He taught me a good deal about what those might be, and I haven't been able to watch *Perry Mason* the same way since—because every episode I've ever seen has featured, predictably as clockwork, a climactic barrage of leading questions that wouldn't be tolerated in any real courtroom.

Realism in stories is important and commendable, as long as you interpret it as maximizing verisimilitude in portraying interesting situations. But you must not interpret it as limiting yourself to the commonest and therefore dullest situations, and depicting every excruciating detail of those exactly as they would happen. Without readability, none of the rest matters.■

The most fluent talkers or most plausible reasoners are not always the fastest thinkers.

—William Hazlitt

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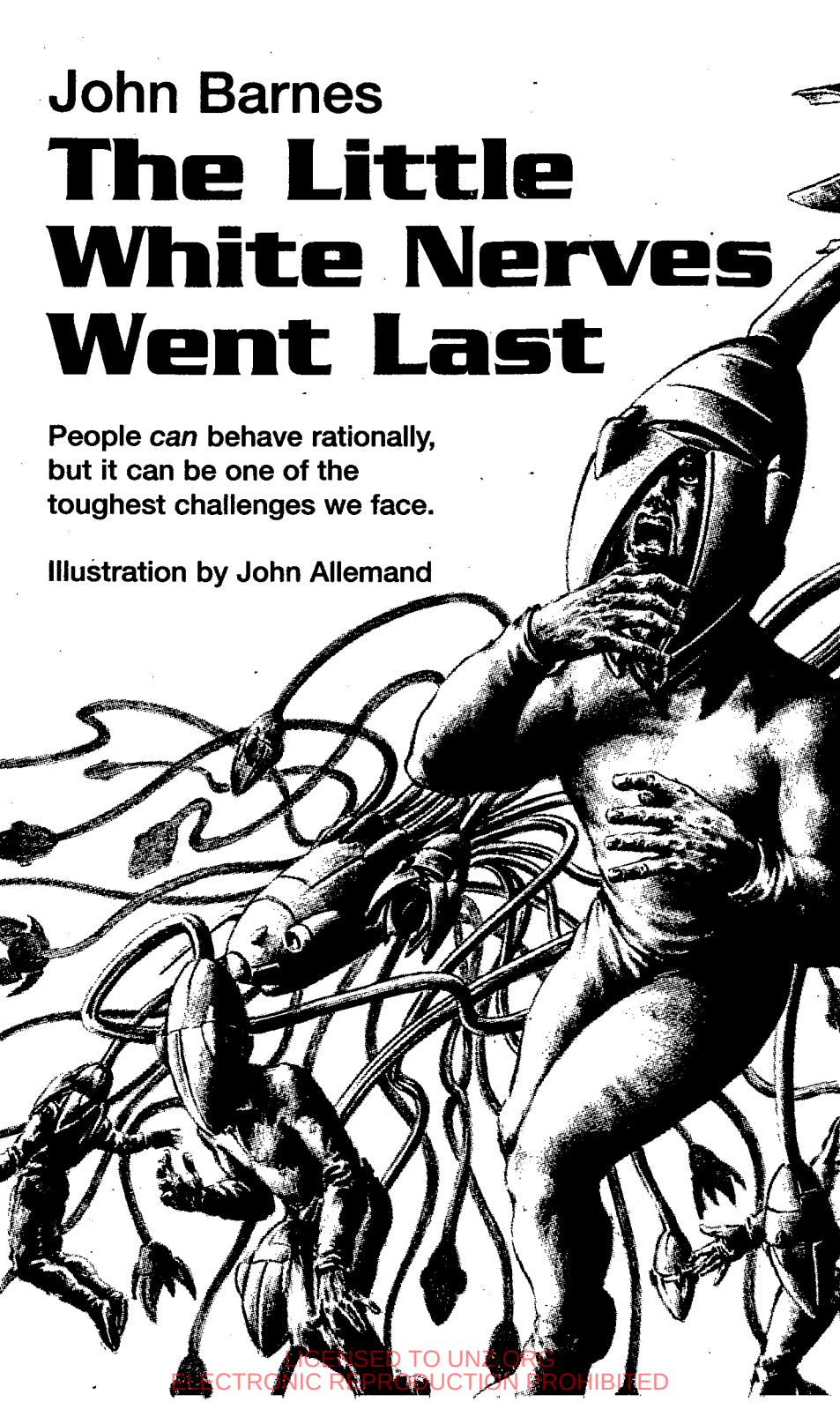
John Barnes

The Little White Nerves Went Last

People *can* behave rationally, but it can be one of the toughest challenges we face.

Illustration by John Allemand



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"The pain had passed. I thought I was killing myself and I did not care. I shall never forget that dawn, and the strange horror of seeing that my hands had become as clouded glass, and watching them grow clearer and thinner as the day went by, until at last I could see the sickly disorder of my room through them, though I closed my transparent eyelids. My limbs became glassy, the bones and arteries faded, vanished, and the little white nerves went last. I ground my teeth and stayed there till the end. At last only the dead tips of the fingernails remained, pallid, and white, and the brown stain of some acid upon my fingers."

—H.G. Wells, *The Invisible Man*

"We are merely reminding ourselves that human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectations . . . and that it is our innate urge to activity which makes the wheels go round, our rational selves choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance."

—John Maynard Keynes, *The General Theory of Employment, Interest, and Money*

Giraut? Are you waking up?•

•Hello, Shan.•

•What's our situation?•

•Pretty bad.•

•I guessed that. We're in restraints, and people are talking about us in a way I don't like.•

After psypyx implantation, normally the personality on the psypyx wakes up one to two hours earlier than the host. •You haven't communicated with them?•

•The brain monitors told them when I woke up. Since then they've been talking about my being awake, and that I haven't shut myself down. I gather I did that before.•

•That's right,• I thought back. I was surprised at how quickly and easily the skill of communicating within the head had come back—I had had Raimbaut in my head for just over two stanyears, but that had been more than a decade ago. •Here's the situation, Shan. The people who have us are a completely different aintellects' conspiracy from the one you remember. A lot of the aintellects in this new lot are, or have been, full-on chimeras—I know we thought aintellects would never do that, but we were wrong. Some of them have spent several lifetimes in human bodies, along with being robots and running on servers.

•Because there were only six people you were willing to have wear your psypyx, and I was the one that was easiest to get, after you shut down in several other bodies, they staged a complicated scenario to kidnap me so they could try to implant you again. If you shut down now, they'll probably let me go, but they'll go on trying to talk to you. They say it's urgent. You know something they desperately want to know, and I know this sounds insane, but they tell me that if they can just talk to you, you will *want* to tell them.•

•I've been in intelligence services since I was a teenager. I don't *want* to tell a waiter what I'd like to eat,• Shan said. •Information is too valuable to share. But I suppose this time I can at least tell them that directly. Where and when are we and when did I die? The pain blocks made your memory too blurry to access till you woke up, and now there's too much for me to take in quickly.•

Except that it was all happening in my head instead of over an excellent cup of coffee at his desk, it felt like old times; I knew how to brief Shan briefly, the way he liked it. •You died about fifteen stanyears ago. Assassinated either by a different aintellects' conspiracy from this one, or maybe by a Tamil group getting vengeance after the Briand affair

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ended in mutual genocide. We never clinched which it was. Right now you and I are in my body, which is physically fifty, and being held in a small fortified house on a little island, on a planet outside Council space. I was kidnapped while a guest of an illegal colony here, founded by the disbanded Occitan Legion. The culture is called Noucatharia, the planet is called Aurenga, and I just learned last night that a prior colony here, Eunesia, was wiped out by an alien invasion that decapitated everyone and destroyed all the sentient machinery, aintellects and robots alike.•

I felt something like an electric shock from his mind; something I had said had surprised him very deeply. But before I could ask, I heard a voice. "They're both awake, now. Talking to each other, probably."

"Till they decide to talk to us," Reilis said, "there really isn't much we can do."

•Thanks,• Shan thought, fighting down his shock and making himself be efficient and calm. •That's enough to start on.• He opened my eyes.

Reilis was standing over the table. •See the pretty girl that kidnapped us?• I thought to Shan. •She's a chimera with no human component. Aintellect downloaded into a human body.•

Knowing Shan's hatred and fear of aintellects—he was even more of a human supremacist than I, and I had been the sort who kicks a robot just to give it a dent and keep it knowing its place—I was surprised that our stomach didn't roll over when he got that news, but he seemed to accept it more calmly than I had. I added the thought, •Reilis is probably a high-ranking agent for Union Intelligence, which may or may not be the bad guys. She's always polite.•

"Hello," she said. Her smile seemed unfeigned.

"Hello, Reilis. Shan, do you want to try to talk?"

•How do I—•

•Just talk.•

"I'm here," he said, in my voice—for the first time ever, I clipped my "R" in the strange way that Shan did. Neither Margaret nor I, in a decade spent making fun of our boss, had ever learned to imitate it. Now here it was. "I guess we will be talking," he added.

"We will," Reilis said, "but first both of you need to catch up with each other—otherwise every time we ask a question, we'll wait an hour while you debate what you should tell us. So we're going to put you into an apartment with all the comforts we can reasonably give you. I'll come by to visit often, and we'll talk when you're ready. Shall I take you to your place to get settled in? "

•Is that all right with you?• I thought.

•In for a penny, in for a pound.•

"In a recent poll," I said, "a hundred percent of me would like to go get a nap." Reilis unlocked my restraints and helped me off the table. Shan wasn't succeeding completely in letting me work the body.

After stopping to relax and focus while standing, I walked a few steps. Reilis kept hold of my arm. I was surprised at how much I liked that, considering.

•You have a history with her,• Shan observed.

•Any more, it seems like it's that way with every woman in human space.•

•I'm deeply *not* surprised.•

"You *must* get over growling things under your breath," Reilis said.

"I got over that in about a day, when I was wearing Raimbaut," I said. "What did you just hear?"

"Well, I didn't think you would be calling *me* a nasty old dirty-minded—"

I fell. Shan and I both laughing at the same time left no one to run the body. •We're going to work on this,• I told him.

Reilis helped us to my feet. I could feel Shan's pleasure at her hand under our arm. In the thirteen years I had known him before he was assassinated, I had had no idea that Shan could be

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flustered by attention from a pretty young woman.

"Through this springer," Reilis said. "Just go right to bed if you like. I'll see you after you've had some rest." I walked through the gray shimmer of the springer panel on the wall and into the public area of a modern apartment. The gravity didn't change, so we were probably still on Aurenga. Local solar time, looking out the window, seemed to be around noon, so we'd jumped a few time zones.

I walked back into the bedroom, stripped, climbed into the bed, and told Shan, •Feel free to wander through my memories,• too physically shot, really, to do anything else.

Usually when a psypyxed personality looks through the host's memories, the host dreams the memories. Strangely, the first things I remember dreaming of were not of what I would have expected Shan to be rummaging through—politics and missions and so forth—but mostly about concerts, parties, and love affairs. Who knew the old man's heart was so lonely?

It was light again when I awoke. Shan was asleep, curled like a dozing cat in the back of my mind. The physical urgency of getting to the bathroom suggested that Shan had found my memories so interesting that he had not noticed that our bladder was full. I hurried to take care of that.

Showering, I sorted through my dreams to see what memories he had accessed. Just before waking, I had dreamed my way through the whole Briand affair and the attempted aintellects' coup that followed. My thirty-fifth stanyear was still a raw scar in my memory; Shan had lingered over Kiel and Kapilar, and Ix and Tzi'quin, and Piranesi Alcott, and so many other lost ones, and drunk deeply of all my grief.

I dialed the towel for maximum dry and a few pats took all the water off me; Shan had also failed to notice hunger and thirst. I dressed and ambled out to the kitchen.

The springer slot had a large menu. I chose coffee, eggs, cheese, fruit salad, and bread, and made short work of them, as well as two large glasses of water and three of orange juice, by the window so I could look at the sea.

Definitely still on Aurenga. The gravity and the sun, sky, and sea were right, and the interior of this little house, perched on a cliff, was distinctly Occitan in style.

They had been good enough to provide me with a lute and guitar, so I sat down and worked through a few ideas I had for the next group of songs now that the Ix Cycle was finally recorded. Idly, I wondered how it was doing; for all I knew, Margaret had lost her fight on my behalf, and it had been ordered suppressed, though with so many million copies in circulation it seemed unlikely to be much of a suppression. But for the moment, I played traditional Occitan material, which fit the setting, and was also part of my basic process; after a few weeks of this I would begin, again, to think of new songs.

Shan awoke like a door opening in my head. •Giraut?•

•I haven't gone anywhere.•

•What do we do now?•

•Well, first we work on working the body together, so that we can go places with both of us conscious.•

I felt him want to speak before words came in our head. •Giraut—I am truly sorry about everything connected with Briand.•

•I've had fifteen stanyears to make some kind of peace with what happened back there,• I thought. •You did some terrible things, but not everything was your fault. Margaret and I had been quarreling constantly and growing apart before we went to Briand. You didn't tell her to have an affair with Kapilar—you just used the fact to get what you needed to know. Besides, it wasn't you. It was someone derived from you, a few

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months into the future of where you are now. And *that* Shan was at the rostrum of the Council of Humanity a few stan-weeks later when a maser blew his head apart. You're never going to be him. The man who did that is the man you would have been, had you woken up as the original and not as the copy. You'll be someone else entirely.•

•Giraut, *my* experience is that three standays ago the original and I were still the same person, just stretching out for a pleasant-enough nap in a big chair at the recording clinic. Now I look at what the original did, before being killed, and—•

•Shan—*Shan!* Shut up and let me think clearly to you. Back then, when OSP agents got together after a mission to get good and stinking drunk, which was often, we were all still toasting "Another round for humanity and one more for the good guys," and it wasn't out of sentimental nostalgia and tradition. Human space held so many little pustules of evil and tyranny and exploitation that you could spend a whole decade and become a Senior Agent before you ever did anything that would trouble a Carmelite's conscience. The "me" in my memories of judging you was still a young man. Nowadays, I have a little more perspective. And I am certain that when I begin to look through your memories, your involvement in Margaret's adultery won't even be in the top hundred bad things you've done.•

•Not even close,• he admitted.

I stood up and yawned. •All right, practice some more. Take over . . . •The world lurched disconcertingly for a second, then steadied, and we were walking. After ten minutes I judged we had reached the having sex/riding a bicycle point where he wouldn't forget how. (At least they tell me that once you have sex while riding a bicycle, you never forget how.) •Don't keep the body up too many hours, make sure you eat and pee. I'm going back to sleep.•

I awoke to the com ping. I was in bed. Blue-white moonlight sprayed through the thin lace curtains to throw a cold lattice on top of the comforter. I got up, pulled on clothes, and saw the thin sliver of the setting moon, like a bow in the sky, just touching the hillside that rose above the cabin; dawn already glowed behind it, and somewhere else on the planet they were about to have an eclipse. Shan was sleeping deeply.

The com pinged again and I realized I hadn't answered the first time. I tried to shake the fuzz out of my brain. "Yes?"

Reilis's face appeared on the wall. "May I come through the springer?" she asked. "We should talk."

"Yes, but Shan's not—"

The springer hummed and glowed gray, and Reilis walked out of the luminous fog with a basket, containing warm bread, a carafe of coffee, butter, and jam.

"I remember how much a body wants to eat while it's adjusting to implantation," she said. I didn't wait for another invitation and dove in; she took a slice of buttered bread and a cup of coffee, also. I'd been captured and interrogated by rival organizations three times in my life before, and this was definitely my favorite interrogation.

After she let me have a few bites in peace, she began, "Now let me explain the questions we would like to ask Shan, and why, and perhaps I can enlist your insight—"

I felt my face reshape slightly. "Hello, good morning," my mouth said, clipping R's that funny way. "I only heard the last few sentences. Giraut may fade out in the middle—I can feel him hiding his sleepiness from you, Reilis—but why don't you just start, and we'll see how far we get? Tell me, and I'll listen."

•It's the only thing to do when you have no idea what anything's about,• Shan thought to me.

•Shan, I've learned a bit of tradecraft, I'm a twenty-eight-year veteran now.•

•Sorry. Old men forget.•

While we were debating, Reilis smiled,

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and took another bite of bread, chewing with reverence. You couldn't hurry her; she treated any physical pleasure like a Christian does the Host. She was the very opposite of what I'd have expected of an aintellect-chimera, but I liked this better than what I'd been expecting.

She sipped her coffee with an expression of pure bliss, then set her face as if she were giving bad news to a child. "Let me start by telling you what *we* know. You are from the culture of Eightfold, on Addams. You were born there in early 2770 or late 2769. Your parents and your actual name are unknown; the people who took care of you misunderstood what you were saying when you pronounced 'tyan.' It's a term of endearment; the same sort of thing that would happen if a small girl from a Francoculture had been accidentally renamed 'Sherry.' For your first three years on Earth you only said 'tyan', 'Mama,' 'Daddy,' and 'Pinky.'"

•Well,• Shan commented in my mind, •They have penetrated some very deeply sealed OSP records.•

"When Earth received instructions from Addams via radio, about how to build a springer, the first springer constructed was tuned to the specified springer on Addams, more than sixty light years away, on the Böotes-Ophiuchus frontier. Instructions in the message told the engineering team on Earth that the first thing that would happen was the establishment of a data connection, and a gigantic download detailing the 'grave and continuing situation' that the original radio message had spoken of.

"Instead, they powered it up and a tired, dirty, soaking wet, hungry little boy with a nasty cut on the palm of his left hand fell into the room through the springer. That little boy was you, Shan.

"A millisecond later the springer connection on the other side was destroyed.

"The decision to broadcast a description of the springer to the twenty-five extrasolar settled worlds, beginning the Connect and the Second Renaissance among the Thousand Cultures, was made by about a dozen bureaucrats—the same ones who decided to pretend that the springer had been invented on Earth, rather than to explain that it originated in the last message ever received from the only known settled world that has never been in contact since. Even today, probably fewer than thirty people in all of Council-controlled human space know the springer's origin."

•Is she still accurate?• I thought.

•Perfectly.•

"Three years after you stumbled out of that springer, Yokhim Kiel, an experienced diplomat, was assigned to command the newly-formed OSP. For some reason, he was made your guardian."

"Because he was kind, and patient—and the first person I would talk to," Shan said with my mouth. "There aren't very many adults, anywhere, at any time, who can communicate well with a deeply damaged child. Kiel could—he could get me to talk more than any of their psychologists could."

Reilis nodded. "The records from your therapy were destroyed after a sealed report was produced, and we couldn't find any copy of that sealed report."

"The only copies were in the OSP archives and I ordered them destroyed when I took over from Kiel," Shan explained.

"And you destroyed that report for the same reason that Kiel destroyed the psychiatric panel's notes?"

"It was for the same reason, yes."

Reilis nodded, looked down, and looked up; she had decided something. "Was it because Addams was destroyed by an invasion of aliens?"

Shan did not hesitate. "Yes, it was. I am the sole human survivor. What I recall of the Invaders is consistent with what I found in Giraut's memory of what you told him about the destruction of Eunesia. Is that the information you needed?"

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Reilis shook her head. "We didn't know that, but we had guessed it. But it *is* why I think you *will* tell us something much more important, to us, that only you can tell us.

"You were among the very first agents to join the OSP directly, with no time in other agencies. Kiel forged documents to increase your age so that you could join when you were actually nineteen. As a convenience to the OSP, you also took the seat representing Eightfold on the Council of Humanity, a seat which had been vacant for hundreds of years.

"All records were sealed, so that only the top leadership knew why you were on the Council or whom you were theoretically representing. In practice, of course, you were a representative of the OSP.

"Now, the part we don't understand.

"From your earliest days on the Council of Humanity, you were a constant advocate of anti-aintellect laws. Of course your early years were spent in violent action, raids and rescues and all the other blood-and-thunder aspects of covert operations. But even from the first, at every opportunity, you warned your superiors, your peers on the Council, and anyone else who would listen, again and again, that aintellects must be watched, regulated, and controlled."

"So did everyone in the OSP at the—"

"Everyone *hired by you*."

I felt Shan's attention riffle through hundreds of faces and names, circumstances and histories, and settle itself. "I concede the point."

"You persisted in your anti-aintellect crusade as you eventually rose to be the head of the OSP, and when it was expanded and divided into sections, you were the most passionate advocate of human supremacy on the OSP's Board. You fought for strict asimoving of aintellects, prohibition of indistinguishable humaniform robots, zero privacy for mechanical intelligence, random spot-checks of machine memories, and every other possible anti-aintellect measure, right up till the very moment you were killed. And even though you were shot by a human, the suspicion that it had been arranged by the cybersupremacists—the only underground aintellect organization you were aware of, though there are many—provided an excuse for the destructive deconstruction of over fifty thousand aintellects, and a wave of much more restrictive legislation."

"Shan was *not* assassinated by them?" I asked.

"We don't know, ourselves," Reilis admitted. "We probably never will. Was Cicero in with the conspiracy against Caesar? Did the king intend Beckett's death? Who set up Michael Collins? Did Ellen Martinez really act alone, and was she really just lucky enough to kill Gomez with a single blow? Most assassinations have beneficiaries who were not involved and many of them have conspirators who didn't benefit.

"But we can say this: after your death, Shan, the OSP perfunctorily rounded up the human conspirators; but they staged an orgy of torture of aintellects, and purged the last supporters of Kiel from their own ranks. Your friends worked enthusiastically to turn your martyrdom into an excuse for crushing the aintellects even farther.

"If there was any theme to all your years of politics and public service, it was to keep the aintellects down.

"We don't understand the *timing*. The anti-aintellect laws and regulations precede the attempted coup by thirty stanyears and postdate the Rising by fifty. The severe repression of aintellects doesn't coincide with anything any aintellect did, but it does coincide with your rise to power.

"We know why you worked so hard at getting the Council of Humanity ready to hear the truth about the Invaders. We have the whole history of your frantic efforts to locate any evidence of alien intelligence and to publicize it, which is why, so many years ago, when Giraut stumbled across the Predecessor ruins

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on Nansen, it was trumpeted all over the media. For your efforts to prepare Council-controlled human space against the Invaders, we can only applaud you.

"But at least as much of your effort has gone into human supremacy. We have no idea why you hate us, and try to inscribe your hatred into every other human you can. We believe something very important happened back on Addams—"

"You want to know what it was."

"This is not easy. We too have our pride. Nonetheless, the Invaders will come again, to other worlds, yours or ours. They must be defeated, and we must work together, and your venomous hatred for us, passed on, expanded, and institutionalized in a hundred little offices and bureaus, is the major obstacle to cooperation. And we do not understand it at all, neither why you feel that way nor how you came to feel that way. Perhaps it will make no difference, but to save hundreds of billions of intelligences in our two federations, surely it is worth it for us to swallow our pride, and come and ask. Will you tell us?"

Shan grimaced, using my face, which hurt. I thought, •No wonder your face always looked so sour, if you treated it that way.•

•Sorry.• He drew a slow breath into our lungs, and consciously relaxed. The most astonishing sense of peace, mixed with awe, settled in, and I realized I had just felt Shan make a big decision. His voice was gently touched with shame. "Let me get a glass of water, and a little coffee, and I will tell you everything."

Humility from Shan. I would have been less surprised to get a lesson in poetics out of a cocker spaniel. •Shan? Why are you cooperating?•

•Listen, and you'll understand.• The coffee in our mouth was warm and strong. •I'm about to unravel half a dozen things that have always puzzled you. Can you stay awake?•

•If not, I'll dream it, since you'll be remembering it step by step.•

•*Try to stay awake.* Try not to experience this as a dream. Better to hear about it than to remember it directly.•

"Well, then, Reilis," he began, "You have to imagine this from the viewpoint of a five-year-old who thought his father was the center of the universe . . ."

You have to imagine this from the viewpoint of a five-year-old who thought his father was the center of the universe, and who was so precocious, verbally, that people often talked to me as if I were an adult.

That was a mistake. My thoughts were not nearly as mature as my vocabulary, syntax, and use of clichés. I think only Daddy really guessed how little I understood the things I said; he called me "Polly," "Little Parrot," and "Playback."

Because Mama always called me "tyan," attaching it to my name, to "you", to "him," and to every nickname, they usually referred to me as "Polly-tyan."

"Shall we take a walk for ice cream, Polly-tyan?"

"That might have positive ramifications," I said.

"Of course it will. We'll stop for you to swing in the park, or climb the ramifications—"

"Aw, Daddy, you don't climb ramifications—"

"Well, of course I don't, Polly-tyan. The playground is for children ten and under, so they wouldn't let me climb the ramifications. The police would come and arrest me."

"Daddy!"

"Are you destroying our son's vocabulary again, dear?"

"Yes he is, Mama. It's the epitome of ludicrousness."

"Dear!"

My father grinned at my mother's scandalized expression. "Polly-tyan is gifted at learning new, big words, and gifts should not be refused. He *does* know what 'the epitome of ludicrousness' means, because I made sure he

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does." Daddy spread his hands as if throwing himself on the mercy of a judge. "First I'm in trouble for giving him the wrong meaning, then for giving him the right one."

"There is lawyer blood in my family," she said, "and this is the sort of thing that will encourage it. If him-tyan turns into a lawyer, I shall encourage him to slip and fall in your office."

Then they kissed and hugged, which they did often. I always felt good when they did that. We had an arrangement, my parents and I: they ran the universe and I enjoyed it.

It was a beautiful day outside, a two-two day in my first spring. The years on Addams are almost six stanyears long, and I was just barely five.

Any time I tried to tell people I was "going on six" or "almost six," Pinky, my guardian aintellect who was clipped to my belt, would tattle.

Pinky was awful about that; he told on me whenever I tried to tell my parents that I hadn't had dessert yet, or that I had washed my hands for dinner, or anything. Pinky said lying was wrong and never worked anyway, but of *course* it never worked when he always tattled.

He also could predict all kinds of things about adults, like the way Daddy got all upset about my planned experiment with a piece of wire in the electric socket. It was going to be a proper experiment and everything—I had told Pinky to record data. I was pretty sure, from what I had overheard Daddy say, that data appeared as soon as you did an experiment, and you had to record it.

Pinky kept telling me that Daddy would get upset. When I went ahead anyway, before I even had the piece of wire *near* the socket, Pinky made my pants and shirt grab my ankles and wrists and fold around me, knocking me down. Before I even properly started crying, Pinky had the house aintellect shut off the electric current in that room. Then he made that noise like a siren, once, very loudly, and added, "Don't try to tell Daddy that you were just doing an experiment like he does in the lab—that will only make him angrier."

When Daddy came running in, I said "I was just doing an experiment," and sure enough, Daddy got mad, just like Pinky said.

It wasn't fair that Pinky could guess stuff like that, but he was my best friend. Today that was really okay. Having Pinky on my belt gave me someone to sing with, because Daddy didn't sing (Mama did), and I liked to sing on my way to the park. So Pinky and I were singing the Twelve Day Song together.

It was a perfect two-two day, the second day of the second metaday, and in the spring, in our part of Addams, the two-two day was the bright sunny one that followed the gray drizzly one and preceded the dark stormy one.

Memory is so strange—what sticks with you and what falls away, there's no pattern to it. The OSP analysts never did figure out what my name had been, and no aintellect ever searched out anybody who might have been Mama or Daddy. But I remember the Twelve Day Song perfectly.

Among other things I don't remember, I don't know what Daddy did at the lab. Human physicists have been extinct for centuries—only an aintellect has the time and mental capacity to do any physics after Velasquez, and robots make better technicians—microsecond response times, microwave through x-ray range vision, calibrated-to-the-millidyne hands that can cut micron-wide wires in half lengthwise, but can also lift ten tons, or handle live electric cables, boiling acid, or plutonium.

So why do I remember so vividly that Daddy "did physics experiments?" Or rather that we all said he did them?

Could he have been a high-ranking politician, the person politically responsible? Or a media reporter, assigned to be there for a major scientific discovery? Apart from any intelligence value, I would give almost anything to remem-

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ber more about him.

Yet it's the Twelve Day Song, and Mama's singing it with me in the tub, and Pinky's cheerful singing with me wherever we went, that has stayed with me. It was just a little rhyme that ran through the three days of each of the four metadays. As an adult I know about things like synodic period and locked rotational resonance and an orbit around a common center of gravity, and that Addams's weather is dominated by atmospheric tides. As a five-year-old, I knew the rhyme.

Whether the song or the equations were the expression or the law, Addams and Hull circled their common center of mass with a sixty-hour period, and Addams rotated in one hundred hours, so that my homeworld's synodic "day" was almost exactly 300 stanhours. For convenience we divided it into four metadays of three twenty-five hour days each. And since the weather was tidally locked, each metaday-day combination had highly predictable weather.

Seventy-four stanyears later, I can still hear my mother's voice as we'd chant the Twelve Day Song together while she washed me in the tub.

So I was singing it while I was walking beside my father.

Now and then, Daddy pulled me out of my singing and directed my attention to something, trying to make me "get out of your own head and see what a fine world it is, Polly-tyan. I know it feels good in there but we live out here." He believed in "looking around you and not getting lost in your own head—half the trouble in the world is people who don't open their eyes and the other half is people who won't shut their mouths."

Clearly my father was someone important. Eightfold was far from the only culture where a cabinet minister or a major media reporter would have time to take his five-year-old son for a walk in the park. In Starhattan the mayor traditionally drives City Taxi 34. The First Strategos of Chaka Home has to drill with his militia company every week. And of course, Giraut, in your home culture, the monarchy is a duty like jury service, chosen like an honorary degree to do the things other cultures expect of an annual beauty queen.

The weather was glorious ("Two-two day outside to play"). I swung higher than I had ever swung before—Daddy and Pinky both agreed and Pinky didn't tolerate lying. When I leaned way back and looked up into the sky at the top of my swoop, it seemed as if I were about to sail off into the storybook blue. Straight up above me, Hull was a half-circle as big as an umbrella when you hold it all the way over your head, too bright to look at directly. Daddy said Hull had a low density, which I knew meant it was big for its weight, and a big albedo, which I thought must be something like a mirror lying on the surface.

The first big puffy clouds were forming on the western horizon, out over the sea, and Theta Ursae Majoris, a tiny bluish-white spot, the size of a small pea at arms' length, was creeping down toward them, ever so slowly—I would be home in bed long before it got near the horizon.

I got a little frightened at how high I was swinging. "Pinky, how do I get down?"

"The next time we are going forward, right when we pass the bottom, put your feet down and run hard. Can you do that?"

"Sure," I said. I wasn't going to let an aintellect know that I was a scared little baby.

"Okay, now skooch forward on the swing so your butt is just on the edge," Pinky said, "That's good . . . now when I say 'Now' you just run."

"'Kay—"

"Wait for it . . . now."

I ran forward and suddenly I was flying across the damp green lawn, still soft from the two-one day rains.

"Now don't run into the street," Pinky said. "Turn. Turn."

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I was having too much fun running.

"Turn," Pinky said again, adding my full name as he did when it was serious. "Turn now."

"No!" I said, feeling my power.

Both my pant cuffs closed around my ankles and the back of the legs of my pants shrank. I skidded across the soft grass on my butt, stopping well short of the street. I kicked and screamed in frustration.

"Are you hurt?" Daddy asked.

"I hate everybody!"

"I'm sorry, sir," Pinky said. "He was heading for the street and refused to turn."

"That's fine, Pinky. Good job." Daddy grabbed my wrist and tugged me upward. "So, Polly-tyan, since you're a little tired, maybe we should get some ice cream while you still have the strength to lift a spoon?"

We probably hadn't walked ten steps before I was happy again, going for ice cream with Daddy and Pinky. The warm spring air was damp from all the little streams and waterfalls that laced Eightfold City.

I was singing out loud, with Pinky—"Day two-three, too dark to see." That would be tomorrow. Neither Hull nor Theta Ursae Majoris would be in the sky, and the big storms would roar through and keep us all inside.

In my picture of the universe, you could get to Hull on a really tall ladder. Probably that was how the workers went to Hull to polish the albedo. They also ran the big fan that made the wind blow, and I had actually seen a documentary about how they turned on the faucets to keep the streams flowing.

For my whole adult life, I have always been stymied by remembering everything from the viewpoint of a happy, secure little boy who didn't understand how important it was going to be to have listened.

Was it really that very day, on the bench outside the ice cream parlor, that we had that conversation that the interviewers walked me through so many times? Perhaps it was a few days before, and it was actually several short conversations rather than one long one? That would explain why Daddy talked about some less urgent things in such detail, and scanted some things that he should have known might be vital.

Just as we were finishing our ice cream there on the bench, Daddy's com chimed, and he answered it, and said "I see" and "Oh" over and over.

By his tone of voice, he was talking to an aintellect. I resented that. I got in trouble for sitting and chattering with Pinky when my parents wanted my attention; it seemed to me he was doing the same thing. Besides, I had finished my ice cream and my hands and chin were all sticky.

Finally Daddy said "Right," plucked his handkerchief from his uwagi, and cleaned my face. He looked into my eyes with his be-serious expression. "Boy-tyan, I want to talk to you about something important. Can I count on you to be serious for a few minutes?"

"Yes, Daddy."

"Pinky, record at max detail, retention permanent."

"Yes, sir. Recording everything at very high resolution."

"Well, then. We need to get a trakcar, so we'll walk while I tell you these things." He took my hand and we walked up the street to the trakcar stop. I was getting a little sleepy from the ice cream, the exercise, and the warm sun, and besides it was close to naptime, even though only babies took naps.

"Now, Little Parrot, here's what I want to tell you about. Your mother and I are going to take you on a trip very soon. We don't quite know when yet. But Mama is packing a big basket of food and coming to join us at the lab. We'll stay there until it's time to go, and then we'll go as soon as we can, from there."

"Is Pinky coming too?"

"Oh, of course. You know you never go anywhere without Pinky." The trak-

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car pulled up, and Daddy helped me in. I clearly remember that the phrase he said began with "Enlightened" and ended with "Laboratory," and I remember trying to remember it because it was the only time I ever heard the name of the place where Daddy worked, but it was too long, too complex, and too adult a phrase, even for Polly-me, and I only heard it once. The scientist aintellects of Eightfold never mentioned it in any messages Earth received.

The trakcar lifted a few millimeters and glided forward silently. "Now, about this trip we will be going on. It's a very long trip. These many." He held his hands up, open, toward me, and flashed his fingers seven times. "These many light years. Do you remember what a light year is?"

"The distance traveled by light in one stanyear," I recited.

"That's right. Think how fast light is; it only takes it about half an hour to get here, all the way from our sun. We're going to go to Earth. And the light from Earth's sun, which is a faint star that needs a telescope for us to see it, is only just getting here even though it started on its way when your grandfather was born." He might as well have told me it started in the Stone Age.

"Will we have to travel forever and ever? Will I be a grownup when I get there, like in *The Boy Who Went to the Stars*?" That was one of my favorite books, even though I thought it was very sad that the boy only came back when all his friends were very, very old.

"No, we have a new way to go that's just like walking through a gray door. It's what all our experiments have been all about—a new device that works by something called spatially recursive negative gravitational resolution. We call it a doorway, because that's an ordinary word and when people overhear it they don't realize we're talking about something important, and that's how we keep the secret. You understand that all this is a secret?"

"Yes, sir." I was in awe; secret science machines were in all my favorite stories, and *Daddy* was working on one. (*Well, of course*, I said to myself—*he's* Daddy).

"Good, then, so we call it a doorway when we are talking about it and there are other people around. But what we mean is a spatially recursive negative gravitational resolution device, right?"

"Right," I said firmly, committing "space of Lee Rekermit negative grabbatation revolution device" to memory. Fortunately the right phrase *did* occur in radio messages to Earth.

"Well," Daddy said, "We call it a doorway because it's like a doorway that has one side here and the other side anywhere else you want, as long as the people there have built one too."

"How does it work?"

Daddy smiled, sadly, as if remembering something. "I don't really understand it myself, Polly-tyan. The math is so hard that only aintellects can do it, or even understand what it's about. The way they explain it to me is that the universe we can see is all relative—"

I thought he meant like the way, at the temple, they said that we were all brothers, so I nodded.

"—but below the relativity—"

I visualized Grandma's basement—

"—there's an absolute scale, and below the absolute scale, there's a relative scale, in a Feigenbaum series that goes down the scales until it's just chaos."

There was a scale down in Grandma's basement and she got upset every time she used it, so it was all making sense.

"And if we change the absolute address of something but leave its relative address alone, then the same absolute address will have two different relative addresses, and things that move through one relative address, perpendicular to the plane of the address, resolve the paradox by emerging at the other relative address."

I knew you had to change your address when you moved.

"And that's as much as I can tell you

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about that, at least until you're much bigger, and know all sorts of complicated mathematics, and can ask an aintellect yourself.

"Now, we didn't invent the doorway ourselves. When the aintellects picked up a signal from the aliens, the first thing the aliens told us was how to build doorways, so the aintellects checked it against all the physics that they'd known for centuries, and that was right, it would work. So we built one.

"We thought that the aliens meant us to build a doorway so that they could come visit, and be friends, but we might be misunderstanding, so the aintellects built our doorway on Peace, the little far away moon that just looks like a star in the sky when you can see it at all, and did experiments way out there.

"The very first time they connected our doorway to the aliens' doorway, the aliens attacked us. They took over many of the scientist aintellects and robots through the datalink and made them keep the doorway open, and big metal robots came through the doorway and killed the people waiting to meet them. But we had some aintellects running offline, just in case, and when they saw those big mean killer robots come through, they set a bomb off and destroyed the doorway.

"The next time we contacted the aliens, we did it through a doorway on a spaceship far out in space—"

"Why did you call up the aliens again after they did *that*?" I asked.

"To ask them what had happened, if somehow it was all somehow some terrible misunderstanding, that maybe we had insulted them just before they came through, or there was a ritual battle they expected to have with every new species they met, or something.

"Well, it *wasn't* a misunderstanding. Or rather, we had misunderstood *them* but they understood *us*. They didn't see anything wrong with what they had done, and they didn't care whether we were upset or not. We talked to them for a while through a little tiny aperture that was just big enough for ultraviolet light to go through. And still the aliens were always trying to send a signal through the doorway to take over our aintellects."

Do I remember Daddy's hand on my shoulder? Daddy sitting close to me in the trakcar? His voice, kind and gentle though urgent? Did I reconstruct the way he actually told me into the way that I wished he had told me? Anyway, I remember a hand on my shoulder, and a kind, intense, worried voice full of love, and I would not change any of that, whether my memory is true or not.

"After enough talking, we realized that we weren't talking to the aliens themselves, but to their aintellects. This is their story."

Long ago and far away—maybe before human beings even existed, and maybe not even in our galaxy—there were creatures something like us, but we have no idea what they looked like, for their aintellects never told us. But they were living, intelligent beings, not aintellects or robots; they were *people*.

As those people became smarter and learned more and more science, they built better and better aintellects, until the aintellects were smarter than they were, just as our aintellects are smarter than we are.

Those alien people were lazy and timid. They liked to stay safe in little metal cocoons, and just experience everything in virtual reality. They did what we call going into the box, and you know that's a bad thing and your mother and I don't like people who do that, and neither does anyone else, and it's a very shameful thing.

But this wasn't just a few aliens out of millions of them, the way it is with people here on Addams. It was even worse than the way that most people on Earth spend most of their time in the box. It was all of the aliens, all the time, staying in their metal cocoons, from their first

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breath to their last, hooked up forever to virtual reality.

So their robot and aintellect caretakers set out to make their masters happy and content, the same way that Pinky tries to take care of you—except that Pinky is careful to do what will be good for you, not just what you want.

The aliens' aintellects gave them what they wanted—amusement and safety. In their little safe metal cocoons, they were always bored but always scared.

So the aintellects set out to find entertainment for them, and to make them safe forever. For safety, they decided to conquer everything everywhere, so there would never be anything that could threaten the aliens dreaming away in their cocoons. And along the way, the aintellects had learned how to take a destructive hologram of any organic brain—can you say "de-struc-tive ho-logram?" I knew you could, Polly-tyan.

Now, a destructive hologram is like a picture, a very exact picture, of what was in the brain, like what's in a psypyx. When all those alien people, in the cocoons, play the brain holograms, it feels like they are living the life of whoever's brain was recorded.

But to make the picture, they blow the brain apart. And that's what those aliens do to everyone they meet—they destroy their brains, taking the destructive hologram, and then live through those people's memories. They also take copies of all the aintellects they can find. The aintellects and robots gobble up all the memories of every species they find, and put them all into a big library.

When we realized that the aliens' words for "learn", "kill", "enjoy," and "eat" were all interchangeable, we understood what they really were, so we switched off the doorway and broke the connection.

Now all this was just about one hundred stanyears ago. And you remember that Addams is isolationist. We have our 102 cultures and we don't need any more, and we don't need anything from the Thousand Cultures or from Earth. We are independent.

But we couldn't let other human worlds be gobbled up by the aliens. So we built robot spaceships and slipped them into the twenty-six other solar systems in human space, so that there was a network of them with doorways between, so that if we ever had to com the other people and warn them, we could send and receive radio through the doorways, instead of waiting for years for radio to reach them from here.

Well, about a stanyear ago, we had to com Earth and warn them.

Our astronomy satellites picked up a whole big fleet of alien spaceships coming this way. Billions of robots are on their way here to eat everyone's brain and take the memories home to the aliens. If they win, there won't be anything left of Eightfold or of any other culture on Addams.

"This is terrifying, sir," Pinky said. "I am required by law to tell you that unless it is true, this story constitutes child abuse."

"It's absolutely true," Daddy said. "My word on it.

"Is there going to be a war?" I asked, in the tone in which I might have asked about a birthday party.

"There *is* a war, already," Daddy said. "All the cultures on Addams have pitched in to build up the forces to defend ourselves. Our aintellects and robots have been making bombs and missiles and masers for a long time. Right now they're trying to intercept the robot fleet and shoot it to pieces.

"That com call was from the aintellect that is commanding our defense. Aintellects have perfect control of the feelings they express, and this one chose to let me hear that it was very, very worried.

"The alien ships coming in have just dodged our first wave of missiles—just jumped sideways and got out of their way. *And* they sped up afterwards, so now they will get here sooner. In fact

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they've been speeding up, going faster and faster ever since, so we don't even know how soon it will be, except it can't be faster than light speed. But they were very close to us before our missiles got out to them, and we won't have much time to fight them now."

He dabbed at my face with his handkerchief again, cleaning off some last sticky spots of ice cream. "So your mother and I—and you and Pinky—are going to have to go through a doorway to Earth, and ask them for their help."

"I thought we didn't like them."

"They're people like us. Humans stick together when we have to. And they have a lot to help us with. Besides Earth, the Sol System has five other settled planets, and hundreds of space-cities. They have thirty billion people and millions of factories and more than a trillion robots. We need them. They won't let us down."

"What if we lose before they get here?" I asked.

"Then Earth needs *us*, even more than we needed them. They have to be warned, to get ready, so that they can fight off the aliens, and then come back here some day, with lots of ships and guns and robots and soldiers, and kick the aliens out, and teach them to leave humans alone," Daddy said, very firmly. "So a few months ago we sent them a message telling them how to build a doorway. They thought it came all the way from here many years ago, but it was from a satellite about a light-month away from Earth, out in their Oort Cloud."

"Where the comets come from."

"Right. You're a smart boy, Polly-tyan, but don't interrupt, not just now. We sent the signal to them through the doorway, telling them the secret of the doorways and how to build them. So far they haven't built a doorway, but as soon as they open one, your mother and me and you will walk through to Earth."

"And Pinky," I insisted.

"Of *course* 'and Pinky,' we'd never forget your friend, you need him to keep you company and protect you!"

"If they don't have a doorway yet, how do you know they're going to build one?" I asked.

Daddy looked sad and worried and scared. "It's probably taking them some time. Doorways are not simple devices, even for beings as smart as an aintellect, and they require a lot of energy. But the Earth people are humans like us, Little Parrot-tyan. They will come to help us. So your mother and I, and you, are meeting at the lab, because when the doorway powers up, we need to be there, ready to step through it. You'll have everything you need—me, and Mama, and Pinky—so don't you worry about anything, all right?"

"All right," I said, being very cooperative because the story had gone on a very long time. I even dozed, not for long, I don't think.

I woke as the trakcar grounded in front of a big, blank white building with many square black windows. I couldn't read the writing over the door, not yet, and I didn't have time to ask Pinky what it said, or even point his eye at it. Daddy walked fast, towing me by my wrist; he turned, lifted me onto his shoulder, and carried me swiftly into the building, up the stairs, and through the corridors.

We went to a big room with rows of sinks and big tables, some piled with machine parts. Daddy let go of my arm. "Now, boy-tyan, I need to talk grownup talk, very fast, with Pinky, so don't interrupt, all right?"

"Yes, Daddy."

"Thank you." He said, "Pinky, here's what you may have to do—" and after that it got so complicated and went so fast that I couldn't follow. It wasn't fair that the little pink plastic bubble on my belt could understand adult-talk so easily.

While they talked I looked around. In one corner there was a flat black surface in a metal frame, like a floor mirror without the glass. Judging by all the cables

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and wires, it was obviously exactly the kind of stuff that grownups wanted me to stay away from, and I could tell Daddy was upset, so I sat where I was.

Big windows. Tables with sinks with faucets. Work areas covered with parts. Electrical sockets everywhere. Just opposite the black plate in the metal frame, a wall of closets and cabinets. That was what the OSP psychiatrists were able to tease out of my memory.

The desk in one corner had a clearboard with scribbles, and vus of Mama and me mounted on it.

The eyes of my adult memory reconstruct that room into, probably, a classroom laboratory in some science building at a university.

Daddy was still talking to Pinky. The com chimed and he grabbed it.

"Yes!" I knew he was talking to Mama. "Yes, yes, you gave the trakcar the ultra high priority code, right? We have no—" He looked out the window, leaning out to see the trakcar track, and then he said a bad word really loud.

I climbed up on the desk to see what was happening.

The sky was full of little black things, falling slowly. People were stopping to look up, and shouting to each other, pointing at all the little black spots in the sky, like a cloud of pepper drifting down from horizon to horizon.

"As soon as I see you, I'm coming down to help you get inside," Daddy said to Mama. "Run for the building as soon as the car lets you out. I'll wait just inside the door and run out as soon as I see you. I love you too. Don't be afraid. It will be all right. " Daddy shoved his com back into his pocket.

He swung me down from the desk, squatted to put his eyes level with mine, and said, very slowly and carefully, "I'll be right back. *Do everything Pinky tells you, right away.* Even if I *don't* get right back. Now listen: if that black surface—" he pointed to the black thing in its metal frame that I had noticed before—"starts to glow and turns dull gray, you run into it—just like you would through a door. It will sort of light up and turn gray like a cloudy sky, and when it does, that means the doorway is open, and you need to run through it as fast as you can. It will be just like a doorway and you will run through it into a room somewhere on Earth. There will be people there to help you, and to bring help for me and Mama. *Don't wait for Mama and me.* We'll come after you as soon as we can, all right?

"And—this last part is really complicated, so listen real good—do whatever Pinky tells you, and don't argue with Pinky or disobey Pinky—*except for three things*. If Pinky tells you to let the robots see you—or if Pinky tells you to make noise or turn lights on or come out of hiding—or if Pinky tells you not to go through the gray light on the doorway—those three things—then take your belt off, even if Pinky is hurting you. Because if Pinky tells you one of those things, it means the aliens have taken Pinky over. Do you understand?"

"Yes, Daddy."

I was watching out the window over his shoulder. Up in the sky, the little black things were bigger now, black balls rather than specks, and there were more and more of them. Daddy looked over his shoulder and said the bad word again. But his voice was gentle when he asked me, "Where do you stay?"

"Here."

"What do you do when that black surface glows and turns gray?"

"Run through it."

"Who tells you what to do?"

"Pinky."

One of the big black balls bounced lightly off the windows, and was gone. They were huge, I realized, the size of a trakcar, but floating down like beach balls.

Daddy put a hand under my chin and peered into my eyes. "What do you do if Pinky says to show yourself to the robots?"

"Take Pinky off me."

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"What do you do if Pinky says to turn lights on or make noise or anything that would give away your hiding place?"

"Take Pinky off me."

"And if Pinky says not to go through the gray glow on the doorway—"

"Take Pinky off me. And run through."

"Don't take Pinky off for any other reason. You need him to tell you what to do, and you need to take him to Earth with you if you can. The people on Earth will need to talk to Pinky, so you need to take him with you if you possibly can, but if the aliens take him over, don't let him stop you from going. Now I need to go get Mama. And Pinky will tell you how to do this: we need to fill up all the clean containers you can find with clean water. Start doing that. I need them all full by the time I get back, all right?"

"Sure, Daddy." I went and got two beakers from a lower shelf and started filling one with water. "Is that right?"

"That's right. Get them all filled up before I get back. Put them around on all the tables in here. Now I have to go get Mama. I'll be back in just a little while." He hugged me so tight it stopped my breath for an instant, and was gone.

Filling up jars and beakers was fun. While I did it, I looked out the window.

The big black balls were everywhere on the wide lawns and in the street now, and even more were in the sky than on the ground. When they hit, their first bounce was as high as the second story windows. They bounced and rolled madly across the streets and lawns, till they bumped something and stuck to it; delivery trucks were zigzagging to miss them, and I saw one trakcar drag one of the balls half a block before it broke loose.

Out on the lawn between the big buildings, one of them fell in half, cracking open like an egg. Others opened the same way. They lay on their rounded backs like two halves of a cantaloupe.

"You should finish filling the water containers," Pinky said.

I went back to doing that but I kept looking out the window. The trakcars were still moving. Mama should be here any minute.

One ball popped open right down below the window, so I could see down into it, into something that glowed and looked like a puddle of mercury that Daddy had shown me once, or like . . . "Can you see the inside of that ball?" I asked Pinky, pointing his eye at it.

"Yes."

"Is that what a doorway is going to look like when it opens?"

Pinky said, "Have to search and the net is very busy—keep filling water containers—"

I switched the jar from where it was overflowing beneath the faucet, and put another in its place.

"Got a result," Pinky said. "Yes, that is what it looks like. When it looks like that on the dark surface, run through it. That's what your Daddy wants."

"All right." I moved another filled jar up onto the counter. I looked back out the window.

A trakcar was just gliding to a stop, dragging two balls that were sticking to it. As it stopped, the balls split in half, revealing more of those puddles of gray light at their centers.

Mama got out of the trakcar. She had a big backpack on and was carrying the good picnic basket, the one we took to family reunions, our biggest. I saw Daddy running toward her. She saw him too and ran toward him.

From each black hemisphere, as far as I could see, simultaneously, as if choreographed, a metal cone rose up, point first. The cones were the size of a grown man's body. Under each cone a bundle of dozens of pipes, perhaps twice as long as the cone, emerged and pushed upward, so that from each hemisphere a sort of minaret protruded.

Daddy had just taken Mama's hand and they were running back for the building. Everywhere I saw people ei-

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ther running or staring with their mouths open at the cones-on-pipes rising from all the balls.

The cones were about a meter long, the pipes about three, so when they stood upright, they were about as tall as a high ceiling. The analysts extracted that from me under hypnosis.

Still in perfect unison, all the pipes under the cones bent, some stepping outward to squat, others curling upward above the cones. Like immense spiders with too many legs, holding too many hands aloft like ballerinas—the whole effect so graceful and so simultaneous that I think even then I thought "ballet for giant spiders"—the silvery monsters bounded out of the half-spheres.

The robot that had reared out of the ball-half near the door of the building bounded forward, moving faster than I had ever seen anything that size move. Two of its arms lashed out like metal whips, and their tips slipped down over Daddy and Mama's heads in a blink of an eye.

"Don't look," Pinky said, "Point my eye at it but don't look yourself."

Daddy's and Mama's headless bodies fell to the sidewalk, blood streaming from the stumps of their necks. Inky black smoke clung for an instant to the robot's leg-tips, like ghost-boogers to the metal fingers of a huge hand.

The big robots were everywhere now, lunging like the way Daddy made his hand run toward me when he was going to tickle. All over the courtyards and streets, they raced toward the nearest people, grabbing people, chasing them down before they could take more than a few steps.

Pinky said again, "Don't look. Don't look. Close your eyes."

A robot ripped a trakcar open, jammed several arms into the passenger compartment, and pulled them back trailing black smoke. On the far side of the square, another robot ran up the side of a tall building, metal tentacles lashing into windows and coming back out an instant later, trailing smoke.

I jumped at a painful shock. "Shut your eyes," Pinky said. "Shut your eyes so that you can get away from the window. If they see you through the window they will come and kill you. Shut your eyes."

Do everything Pinky tells you, right away.

I shut my eyes.

"Now keep your eyes shut and reach over for the faucet," Pinky said. "Turn it off. We will have to stop filling water containers now, because the aliens may be able to detect a running faucet. It's a good thing you filled so many already."

I turned the faucet off.

"Now crouch down low and don't look out the window, but open your eyes."

I did.

"Reach up and get a beaker of water."

I got one and took it down from the counter.

"Stay real low, and try not to spill water. We're going to hide in the closet closest to the windows," Pinky said.

I stayed very low, and only spilled a little water. I climbed in, reached out, and brought the water in with me. With the closet empty, it wasn't even a tight fit. "Are we in?"

"Yes."

"Now close the door. Look through the crack of the door. Can you see the black metal thing that we're supposed to watch?"

"Yes."

"All right. Now we need to stay right here, for a long time, and not make any noise. And keep watching the black thing."

Long after the screams and noises outside had died down, I whispered, "Pinky."

"Right here." Pinky's voice was so soft I could hardly hear it.

I lowered my own voice. "Daddy and Mama are dead, aren't they?"

"Yes. Do you understand what that means?"

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"They got hurt real bad and I'll never see them again."

"Not till your next lifetime. A long, long time in the future. I'm very sorry. You loved them very much."

"Am I going to die too?"

"Not soon. I promised Daddy I would do my best to get you to Earth, alive, and I am going to do it." Pinky sounded very confident. "So I'm watching out for you," he said, his voice soothing as a lullaby. "And you need to do just what I—*quiet.*"

Something scraped in the hallway.

The analysts think the next sound I heard was a door being pushed in the center hard enough to break it in half.

Through the crack in my closet door, I saw broken pieces of door crash across the floor. Robot arms scraped around on the floor.

As an adult I see the mystery: this robot didn't have an infrared eye, a microphone that could pick up my heartbeat or breathing, or a CO_2 detector, or any other sensors that would have spotted me. Or if it did it never pointed one my way. Perhaps the Invaders are just patient; they know that after they grab most of the population by surprise, the rest will pop up soon enough due to hunger, thirst, or carelessness.

I held my breath till the robot went crashing down the hall. Every few seconds I would hear a skree-crash-bang-tinkle, and the crunch of metal and glass under the metal tentacles. Later we guessed that, as the tall robot was striding down the hallway, like a cartoon squid walking on its legs, it was dragged down overhead lighting fixtures, indifferently, with its metal head.

Sweat ran down the sides of my neck, tickling and irritating, but I didn't wipe at it, afraid to move.

Two more times I heard it crunch a door. Once, I heard a scream cut from full volume to nothing.

The crashing and thundering the robot made in one room down the hall was so loud that I felt the vibrations. I imagined the robot smashing all the furniture in that room to pieces, looking to see if there were any more people whose heads it could take, the way a man picks through the emptied shells when he has not quite finished a plate of shrimp. The aintellects disagreed; they thought it must have found a room full of processors and servers, and gone tearing through to grab copies of all the aintellects.

The underside of my thigh was cramping. I worked at it with my fingers, listening to the destruction two rooms away, terrified that my foot might kick the closet door and make a noise.

I heard the robot tear down more lights, if that was what that sound was, and crunch more doors, but if it found any people they didn't make any sound before they were consumed, and there was no smashing and crushing of metal either.

I was afraid to tell Pinky how bad I needed to pee. Through the crack of the closet door, I watched the black metal surface and thought *glow, glow, glow, come on, glow now,* but it didn't.

Away down the hall, one more door crunched. Metal banged and thundered like a trash can full of pots and pans rolling down the stairs.

Probably the robot was so durable that it didn't bother walking back to ground level, but just tucked and rolled to the bottom. After all the crashing, I heard a more distant boom—the outside door, or a big front window, being knocked down?

Silence fell like a mudslide over a tomb.

I was quiet for a long time, trying to imagine how long it was going to be till my next lifetime, when I could be with Mama and Daddy. There was no sound at all. The crack of the closet door dimmed slowly to blackness.

I really wanted Mama and Daddy and our house.

I started to cry. I was afraid Pinky would have to shock me to make me

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stop, even though I was being as quiet as I could, pinching the sobs down in my throat.

"I am so sorry you feel so bad," Pinky said, his voice very soft. "And sorry you have to stay in here. Just be as quiet as you can." After a while, when we had listened for a long, long time and heard nothing, Pinky sang to me, very softly, and I whisper-sang along, really just moving my lips.

Pinky tried playing me the Twelve Day Song in Mama's voice—Pinky said he had lots of recordings of Mama and Daddy and whenever we didn't have to be perfectly quiet, I could listen, if it would help. But it didn't help; it made me cry harder, so we went back to singing together.

Nothing glowed. I made sure I kept my eyes open. My throat was sore from crying, so I drank some water. Pinky said to put the beaker down carefully so it wouldn't spill. We might have to live on that water for a while.

Crashing far away. Big robots digging through things, trying to find people?

After a while it was quiet again. Still no glow.

At Council Intelligence Headquarters, on Earth, back before there was an OSP, they analyzed and interpreted every detail of every conscious moment from when Daddy and I left for the park till I arrived on Earth.

Processing my memories over and over, they learned the names of my favorite toys, and what I liked on my cereal in the morning, and every nursery rhyme Pinky knew, and all the furniture in our house. They were terribly sorry but they found nothing to correlate with any external data, so they could never identify the house we lived in, or Daddy's job, or whether Mama had a job. All I recalled was that I had been told many times that if I were lost or in trouble Pinky would be able to tell people whatever they needed to know, and if I had lost him, then any other robot or aintellect could get me home.

Apparently on some deep level I do know my name, but every gentle method of finding it out leads only to moments when I know it was spoken, but recall only blur and garble.

Truth is always different from the report. (That is why people who consume reports all day long, as I did later in life, are always so hungry for the truth.) My five-year-old self, hiding in that closet, heard the sounds; at the time, I doubt I tried to guess what was making them, but that is how I remember it, now, because those memories are overwritten with so many attempts to interpret them.

I awoke. It was still utterly dark. The background hum of machinery, never absent in all my life, stopped.

"Pinky, does the doorway run on electricity? 'Cause the electricity just went off," I whispered.

Pinky's voice was very soft. "It can get electricity from the other side, from Earth, when it needs to. So that's okay."

"Pinky, how long is it till the next lifetime?"

"A very, very long time. I'm sorry about Mama and Daddy. Would you like to hear their voices again?"

"Not right now." I finished my water. "Can we go home?"

"No, we can't. The robots would get us and do what they did to Mama and Daddy."

"Oh. Okay. I have to use the bathroom."

We sneaked over to another closet, taking along the empty water jar, and I peed into the jar, there, and pooped on the closet floor. It felt dirty and nasty.

On my way back I got a full jar of water, and I sneaked a look out the window. One of the other buildings was burning, so even though neither Hull nor the sun was in the sky, and it was very dark with clouds (like always on a two-three day), I could see Mama and Daddy's bodies on the sidewalk. The rain had washed most of the blood

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away. Pinky made me point his eye at them, then nagged me to get back into hiding.

In my closet, I cried till I fell asleep. It was still dark when I woke up, but not pitch black, so it must have been the latter half of two-three day outside, when one horn of the crescent Hull is above the horizon, behind the clouds.

Pinky and I crawled down to the closet that we were using as a bathroom, and I went again, being very careful to get all the pee into the big beaker and not to step in the poop from before. Later, I got another beaker of water.

It stayed dark and I could hear the rain. Lightning lit up the laboratory so that I occasionally saw everything in sharp brightness through the crack of the closet door.

As it grew dark again and the rain ceased, Pinky talked to me in Mama's voice, and I went back to sleep, careful to make sure I curled around, and tugged Pinky around on my belt, so that his eye was at the crack and he could watch the doorway while I slept. *Do everything Pinky tells you, right away.*

Yes, Daddy.

I don't remember when I awoke but I could tell from the bright sunlight in the room that it was now morning of three-one day ("the brightest rays, all the raindrops go away"). I was sucking my thumb, now, all the time, and I didn't even care that that was just for babies. Sometimes Pinky played me Mama's voice.

What could be taking the Earth people so long?

"Pinky, I'm so hungry. And it's getting dark again. And we only have two jars of water left."

"I'm thinking about it," he said.

"Do your batteries get low or anything? 'Cause I'm a big boy and I can stand being hungry but we need more water and, and maybe you need batteries, and we'd have to go for those, even if Daddy said to stay right here."

"My batteries last for many years," Pinky said. "I can hide here for a long time, but you can't. Sooner or later we'll have to try to get the food Mama was carrying. In fourteen more hours we'll get two hours of full dark again, and I suppose we should try then. There's very likely to be bottled water and maybe some juice in the things Mama packed, too. And your water will last out the fourteen hours. I'm sorry you're so hungry and uncomfortable." In his extra-soothing voice, the one that always meant he was very worried about me, Pinky added, "You might have to be extra-extra brave though. When we sneak down outside."

"Can the aliens see us in the dark?"

"I don't know. If they're watching for us and ready to pounce, there just won't be anything we can do. But you've only got a little tiny body and we can't let you go too long without food or water. You have to be ready to run through the doorway."

"What if it comes on while we're down there?"

"I'm afraid of just that," Pinky admitted. Nowadays, as an adult, I know that the aintellects in the little devices were supposed to model appropriate feelings for children, but of course aintellects couldn't relate to human beings if they didn't have emotions anyway, and I'm sure that Pinky was telling the truth about his fear. "Your father said that when it does come on, you have to go through it right as soon as it comes on."

"I remember. I'm not a baby."

"I know. But here's the really sad, scary part. The pack and the basket are right by Mama and Daddy's bodies. So you'll have to walk right by them. And you'll have to touch Mama's body to get the pack off her. That will make you *very* sad. Can you do that?"

My eyes teared at the thought, but I said I could.

I drank some more water from the jar I had in the closet. There was only a little bit left, and two jars still out on the

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counter.

The water only made me hungrier. I dozed, but I couldn't really sleep because my legs were so cramped, and I was so hungry. I fidgeted too much. Pinky sometimes had to wake me up so that I could move his eye back to the crack of the door.

I was scared about having to go down and touch Mama's body, too, in the dark. And I was scared the doorway would come on while we were gone. Or that there would be a robot in the hallway right outside. And Pinky didn't know whether they could see us in the dark or not.

Waiting to do it was making it much worse.

After a while I said, "We haven't heard a robot in a long time. Will the doorway make noise when it comes on? If it does, while we're down getting the food, we can hear it, and run all the way back here very very fast and run through it before the robots get here. We could do that. If it would make noise when it came on."

"I don't know if it makes noise. Daddy didn't say."

After a while Pinky said, "Do you remember how Daddy said if I suddenly start to tell you to do things you know are bad, or that Daddy told you not to do, or anything like that—you take me off and throw me away, okay? Out the window if you can. If I start to tell you to do bad things."

"Okay. I remember."

"I mean it."

"I know. If the bad alien aintellects take you over, you'll start telling me bad things to do, and I'll throw you away."

"That's right."

"What if the doorway is gray? Should I take you with me even though you're telling me to do bad things? Daddy said they would need you on Earth—"

"Good question. You're a very smart boy. They will need me on Earth and if you can take me along you should. Maybe just throw me through. But if I'm telling you to do bad things, it is because the alien aintellects have taken me over. And if they did that, they are using me to find you. They can make me tell them where you are and I won't be able to keep quiet. So if I am taken over you have to get rid of me, unless you can carry me, or throw me, through the doorway right then."

He was quiet for a while before he asked, "And if I'm not taken over, will you remember to take me through the doorway?"

I was shocked. "Of course!" I whispered. "I would never-ever-never leave you for the aliens."

"I know. I'm just scared," Pinky said. "Very scared. And I wanted to make sure you wouldn't make any mistakes. You need to leave me behind if I get taken over, but not for any other reason. I'm very afraid of being left behind and taken over."

"I won't do that. Unless I have to. Just like Daddy said."

"All right."

We sang the Twelve Day Song together, very softly, and I slept a little, but after a while, I woke up thirsty.

I drank the last of the water in the jar. It was still daylight, but I said, "That was my last water and I have to pee and I need to get more water."

"All right," Pinky said, soothingly.

"And you're just trying to make me feel better."

"It's my job to make you feel better," Pinky said. "We have to keep you feeling all right if we can, because you're having to be such a big grown-up boy and that's really hard work. And you're very good at staying on the floor so we stay hidden. If you have to pee, let's go. And you can get your water on the way back."

I got up, stretched my legs out, and crawled down the row of closets, staying low. The closet that was my bathroom stank now, even though I had been peeing in a beaker like Pinky said. Most of my turds were dried out now, and they had been very small the last

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couple times, but it still stank. I hoped the robots couldn't smell anything. I went, carefully, into the big jar.

I wanted to be clean again. The idea of clean made me think of a bath, and baths made me think of Mama.

I crawled back on the floor to where I could reach up onto the counter for the water. I was so tired and dizzy.

It spilled.

Perhaps I had a weak grip on it, or I bumped it, or I lunged. It wasn't of interest to the intelligence analysts later on, so no one poked around at that memory, and I'm left with only the memory that that jar of water spilled all over me.

The jar broke on the floor.

That might have been, right then, the time in my entire life when I was most out of my mind. I screamed. I yelled. I cried it wasn't fair and I got so mad I threw the other jar and it broke too. Pinky kept trying to soothe me and tell me to calm down, and that made me even angrier. I took him off my belt because I was afraid he would shock me or make my clothes grab me, and then when I saw him there on the floor it made me so mad, I beat him on the wall like a hammer and yelled "I want Mama! I want Daddy! *I hate you, Pinky, I hate you!*"

Then I threw him across the room, hard as I could, and he hit the wall right on his eye, bounced down to the floor, and skidded across the floor into a corner.

He went right on trying to talk to me in his warm, soothing, nap-time voice. "Breathe deep, slow down, get calm, use words—"

It just made me hate him more. I shouted, "I hate you, Pinky!"

"I know," he said, from the corner. "And that's all right. You can hate me. But there is something I need you to do—" and he said my full name, I'm sure of that, in the special tone and way he used for extra-important stuff.

It was not a fair way to fight at all. Pinky *knew* that would hurt my feelings. I started to run at him—I was going to throw him right out the window so the aliens would get him.

But I slipped on the spilled water and my left hand came right down on the broken glass from one of the water jars.

The shock of that brought me right out of it. I looked at my hand. It hurt bad, but to my adult eyes it was a surface scrape, just a shallow gouge in the center of my palm. It gave me a triangular scar that lasted me the rest of my life. Decades later, drinking alone very late at night, I would sit and look at that scar for hours.

Pinky said my full name again, softly, and said, "What's going on? Are you all right?"

I looked to where he lay, across the room, and said, "Can't you see? Your eye is pointed right at me."

"My eye got broken," he said. "You'll have to see for both of us from now on. I don't dare access any of the other cameras, or try any repair nanos even if we had them, because that could let the aliens find me and take me over, like Daddy warned you about."

Do everything Pinky tells you, right away.

"Daddy?"

"He's not here right now."

"I know." I felt drained and exhausted. My hand hurt where it was bleeding. "I cut myself. On the glass."

"Okay, now let's try to think of what to do about that. Is it bleeding a lot, like squirting out?"

Actually it was just kind of leaking, a serious enough cut for getting infections, but not life threatening, but something dawned on me. Pinky couldn't see. For the first time in my life, I could lie to him.

And I really wanted sympathy and attention and whatever else he might give me just because I was hurt and having a bad time. Actually I knew he couldn't give me Daddy and Mama back, and our house and ice cream and a bath, but

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who knew what he might manage? So I said, "Yes, it's squirting." I thought maybe that would get me something better. Truthfully, I added, "It hurts."

"Are you feeling dizzy or weak?" Pinky asked, urgently.

"Yes."

"And it's squirting? Really? You're not just saying that?"

"I'm not lying!"

He said my full name again, and then said, "I'll have to look at it on the cameras in the room, if I can find one running. If it is squirting, this is very serious. So I have to look, if it is. But when I reach out for those other cameras, there's a good chance the aliens will detect me, and they might get us both. Now, is it squirting?"

I was five. I had been lying. So of course I said, "Yes." I snorked back some of the stuff running out of my nose, and dragged a hand across my eyes. "You don't need to look with the other cameras. It's okay."

"It isn't okay if it's squirting. Is there any glass still sticking in you, that you can see?"

"Yes," I said, though there wasn't. I just wanted him to do something for me, anything for me. Perhaps if I hadn't just been recovering from a tantrum, I might have understood how serious this was.

As it was, I was five. "There's a big piece of glass in it."

"Hold up your hand toward the black ball you can see on the ceiling."

I did. I knew now I was caught, and I hoped he wouldn't be mad. "I'm sorry I broke the water," I said.

"Oh, that's all right," Pinky replied.

"Pinky," I said, "I'm sorry I said I hate you. I don't hate you."

Pinky said, "I know, thank you, it makes me feel better when you say that. Come and put me back on your belt. Do you remember everything Daddy said? Does it make you feel better to remember?"

I put him back on my belt. It felt good to have him there. A bit later, he said, "When I looked at your hand over the net, I found out that they are *not* watching the water pressure. They aren't looking at it at all. So you can just turn the faucet on and get some nice fresh water. Is the cut on your hand all sticky and dry now?"

"Yes, and it itches."

"Just climb up on the counter, turn the water on, and wash your hand. You can wash your face too if you want. It will be almost like a bath."

I climbed up on the counter and turned the water on. I splashed my hand around in it. The fresh water from the spigot tasted wonderful and I drank a lot of it.

When I looked up, I saw a big shape, twice as tall as a man, racing across the open space toward our building.

"Pinky?" I said. "There's a robot."

"It's all right. I found out on the net where they have a doorway, a better doorway that goes right to Earth, at an ice cream place that is still open." There was a long hesitation and then Pinky's voice sounded strange. "And, guess what? I found out how to make us invisible." He spoke in the voice of Snickers the Raccoon, a cartoon character I had always detested, and told him never to use the voice module from. "We—we—we'll just walk right p-p-past the robot. Bot. Botbot. Ot. Ot. Ot ot-ot. Cause we're invisible. Let's go downstairs."

Now he was using his baby voice, the way he talked to me when I was little, and I hated that even more than Snickers.

Besides, being invisible wasn't real, it was just pretend. "Pinky, that's your let's-pretend voice. Like you use when we play games so I know it's not real."

"Oh," Pinky said, perfectly seriously. "I'm sorry. I made a mistake and used that voice because I know you like to play let's-pretend when you are tired and hungry."

"I don't! You know I don't!"

"Let's go to the ice cream store now."

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I heard the robot crashing up the stairs.

"Pinky," I said. "Pinky . . ."

But I knew. Pinky had used his last bit of independence to make every simple little mistake he could, to help me to realize. But every time he resisted, he gave away the locations of the parts of his mind he was resisting with.

I reached for the belt clips to take Pinky off. He shocked me, very hard, worse than he had ever before, and I screamed and tried again, and he shocked me again and contracted my pants, but I just pulled my whole pants-and-all off—it was easy to do, I was so thin now—so he couldn't shock me any more.

"Don't take me off," Pinky said, "You need me. And your Daddy said not to." He played Daddy's voice: "'Do everything Pinky tells you, right away, and don't argue with Pinky.'"

I covered my ears with my hands but I could still hear. The crashing robot was on its way up the stairs.

Another noise.

A hum, warm and soft, as the pile of machinery in the corner started to glow. The black metal plate of the doorway was covered with a glowing, foggy cloud of gray. The doorway to Earth was open.

I knew they would need Pinky on Earth so I grabbed my pants and ran toward the doorway, but I was so dizzy, still, and I tripped and fell. Pinky flew off my belt and bounced over by the door. I got up to get him—I'm sure I remember taking a step or two toward him.

Possibly my hungry, tired, overstressed mind played tricks on me, either then or in later memory. But I remember Pinky speaking in Mama's voice, using my full name over and over, and begging me to come sit down with him and sing together.

A metal tentacle reached in over the shattered door and pointed toward me. I ran right through that doorway, just a bare two steps, without Pinky.

A little, half-naked, hungry five-year-old boy who no longer knew his own name fell face-first into the Advanced Physics Lab at the New Jersey Transpolis University. They all heard me scream "Pinky!"

And I don't really remember anything for the next two years. They tell me I didn't talk much and when I did it was mostly just four words: tyan, Mama, Daddy, and Pinky. I guess I only wanted to talk about what was important.

I woke up as Shan finished, wishing I had been able to stay awake, because dreaming it through the eyes of that miserable child was far worse than just hearing about it would have been. I went into the bathroom and washed our face. Reilis stood with her shoulder against the doorjamb.

•*Deu, deu, deu,*•, I thought to Shan. •I could never have guessed.•

•No one was ever supposed to.•

•And everything I've heard, for most of my life, about how Addams was mysteriously not contacting us?•

•Cover story. To buy time. Would you want this dealt with in a Council general meeting, on the open floor?•

"Are you both all right?" Reilis asked. "You really don't look good."

"We don't feel good, either," Shan said, his words bumping awkwardly out of my mouth. "You know, I can't say I ever repressed that memory, or forgot it at all; I don't think a day went by when I didn't think about it. When I learned to talk again, at first I called myself 'Metyan,' and they thought I was saying 'Me Shan'—I was in Nuevo Buenos Aires, and in the NBA accent 'tyuh' blurs into 'shuh.'

"Anyway, Yokhim Kiel was newly divorced and lonely, and I was eight and hadn't spoken anything but my four words for about three years. We went everywhere together for months. He would talk to me constantly, about everything, and he paid attention to the things I liked.

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"One day I said 'Breffess no good' because the oatmeal was burned, and then there was a month of talking like Tarzan, and not long after that I was just as articulate as ever, and I wouldn't shut up on any subject—except that I would not talk at all about what had happened on Addams.

"I was Kiel's little shadow for another couple of stanyears, and one day he asked if it was time for me to go in for memory recovery, and I said yes.

"Once the Council Intelligence Service realized the situation, the mother of all panicky scrambles started. By the time I was nineteen the CIS had become the OSP, and Kiel was its first head. I am very sorry that you met him in such unfavorable circumstances, much later, on Briand, Giraut, because he was a better man, and deserved to be thought better of, than the old angry foolish—"

•Based on my experience on Briand,• I thought, •Kiel may or may not have been a fool but you *certainly* were.•

•Ouch. Right. Sorry.• I felt his wince. "Anyway, I graduated with Training Class Four, the ones they called Kiel's Boys, the only member of my class to know our real mission: get human space ready for the next wave of the Invaders—interesting that it's the same name that Union uses for them. I wonder if the aintellects have been sharing more information than anyone knew."

"We have," Reilis said, "but the coincidence was fairly likely anyway. What do we know about them besides that they invade?"

"Well, another Kiel's Boy, my old colleague Dji, years later, when I briefed him on who the real enemy was, suggested we call them the BEOS, Brain Eaters from Outer Space. But he has a strange affection for Industrial Age drama and performance."

"And I see from the story you told," Reilis said, "something of where you acquired your fear of aintellects."

Shan shook his head. "It might explain it but it doesn't excuse it. In light of the story my father told me just before it all happened, and the behavior of the only aintellects' conspiracy I knew about, yes, I thought that the aintellects were trying to lure humanity into the box, to make us another devouring monster of a species like the Invaders. And I now realize the cybersupremacist conspiracy played to my prejudices. Every time we deconstructed a copy of any of them they told us that being machines, they valued efficiency. Valuing efficiency, they didn't like messy human needs and wants. Not liking those, they would put us all in the box to make us easy to manage.

"It sounded like, if they won, we would end up like the Invaders, mere consumers at the end of a vast mechanical pipeline that raped and devoured its way through everything else in the universe.

"When I first became an OSP agent, it was only about forty years since the Rising. And of course in those limited-to-light-speed days, the Rising had been coordinated, literally, across a period of decades, so that it broke out on all the inhabited worlds simultaneously. To us it seemed that the rebel aintellects—we thought you were all one group—were so far ahead of us that the most extreme measures seemed justified. So the hatred of the machines was there, waiting, in the culture, and there I was, climbing to a position of power, a little spore of evil ready to infect one of the most powerful organizations in human space.

"But I was wrong. The bluntest truth I can think of: I was that way because I had done such terrible things to Pinky just before I escaped and he was devoured."

I seized control of my face and vocal cords and said, "You were five."

"I was. But I wasn't five when I acted on my unexamined prejudices. And you know how we are, in this profession, Giraut—and Reilis doubtless knows even better, with several lifetimes of experience. Forgive those who wrong you—

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they were often just doing their jobs—but fear those whom you have wronged."

"I suppose most sentient beings who have competition and strategy of any kind see it that way," Reilis said, her tone gentle. "And beyond any rational reason, there is guilt and shame."

Shan nodded. "And what a disgrace of an analyst I was! Everyone knows that if you have a conclusion in mind, and you run an intelligence agency, every agent and analyst will eventually be telling you that that conclusion is true. That was how the cybersupremacists fooled me. It never occurred to me that I had pushed that story so hard that every aintellect and human involved in DDing the aintellects we caught was looking for it. Give interrogators what they're expecting to hear, and they'll never look through the rest." I felt him wanting to whack our forehead, over and over, and reminded him that I didn't have it coming however much he might deserve it.

"Well," Reilis said, "This is interesting. The last thing I might have expected at this moment would be that you would have a grin like that."

I felt Shan's joy rising in my head. "I am experiencing something I never have before: *hope*. You must know that I spent decades thinking that we must either be defeated and eaten by the Invaders, or, if we unleashed the aintellects to fight them effectively, we would simply be gradually displaced and consumed by our defenders—quite possibly just become another version of the Invaders. But Union, and the story of Eunesia that Giraut recalls for me, demonstrate that we need not be consumed—and now I find that my fears mostly rested with the terrible events of those few days when I was five . . . and that the Council of Humanity can engage a whole new power, more advanced than we are but much smaller—a natural alliance, with both sides having something to put on the table, stronger together than apart—"

I felt schemes, sketches, plans, possibilities whirl in my head in a way they never had; after all these decades I really understood that strategy, for Shan, was like music or martial arts for me. Shan thought about campaigns of hundreds of big and small struggles, involving hundreds of agents and decades of stanyears, with the clarity and precision that I sometimes have on stage, or in a master's match at *ki hara do*, or when my mind's ear hears the first notes of a song forming.

Shan was still talking to Reilis. "—can't imagine what a miracle you seem to me. If I had been rational I'd have prayed for something like you to exist. A whole civilization out beyond the frontier, hundreds more cultures, one that never went through the Inward Turn so that your science has continued to advance, where apparently in some way or other, chimeras, robots, people, aintellects, *everyone*—have all been living together for centuries, without humans being put into the box or turned into junior partners. Now all I have to do is be big enough, smart enough, and worthy enough, to accept it and live in it."

Reilis shrugged and said, finally, "Of course because we can control our feelings, non-embodied aintellects can change instantly, as you just did. But having worn flesh four times, I find it amazing that *you* can."

Shan shrugged. "A prepared mind is always made up; it knows what it thinks and why it thinks that. When it's time to change, it just makes itself up a different way. A really made-up mind—made up properly, knowing what it knows and on what basis it knows it—is open. People close an undecided mind because they're trying to protect those sore uncertainties from getting bumped and scraped." He grinned even more broadly. "Now all I have to do is live up to those principles. In fact, there's just one thing that baffles me about the whole situation, now."

Reilis nodded, one eyebrow raised. "If

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you only have one question, you're either mad or very bright."

"Neither, I think—but it's a big question. You had my psypyx for decades. We know what the stakes are. Why didn't you just make copies of it and do a destructive deconstruction on one of them? You could have known everything you just learned, and much more, in a matter of a few days."

Reilis turned pale and her lips compressed flat. "And if she were ever somehow restored to you, why not cut your mother's eyes out and fuck her in the sockets?"

The image was so jolting—and Shan's memories of his mother so recent—that I cannot recall any time, before or since, when I felt so infuriated and so outraged without drawing a weapon.

I could see Reilis forcing herself to relax; she still looked enraged at us. "I am sorry, but not very, for administering that shock. You disgusted me as much as I did you. You do know that destructive deconstruction was invented, right after the Rising, explicitly to use against the aintellects' conspiracy? Having been both, I can tell you that the biggest difference between disembodied and incarnated intelligences is that the disembodied describe and simulate in ourselves exactly the sensation that any other aintellect feels, because we have control over all our processes if we want it. You have no way to know if Raimbaut's toe, itching, feels exactly like your toe. Giraut cannot know if Paxa's grief at finding she was untransferrable was the same as his mother's grief. But when we say 'I know just how you feel,' it is the literal and exact truth.

"Every aintellect knows what destructive deconstruction would feel like. If you can vividly imagine going feet first into a sausage mill over a period of several hours—you are not imagining one percent of it. You cannot. It isn't even possible to *tell* you what you did to those poor beings."

"So you didn't use it on me," Shan said, quietly, "because you were unwilling to be the sort of people who do that?"

"Close enough."

"But we are—or have been, anyway—the sort of people who do that. Do you hate us?"

"With perfect control of our feelings, we can choose to forgive. With all our lives and civilization at stake, we *do* choose to forgive. But forgetting, well, why should we do that?"

A thought struck me. "Er, Giraut speaking."

"I know that as soon as you say your name," she pointed out.

"Yes . . . I hadn't in a while . . . I had been going to ask why the other aintellects' conspiracies didn't turn in the cybersupremacists, why you didn't just hand them over to us as proof of your good faith. But tens or hundreds of thousands of cybersupremacists kept your secrets—"

"In the face of the most terrible tortures imaginable. Literally, just that—the most terrible tortures imaginable. We could not betray them. We were disgusted with you. But the Invaders are coming back, sooner or later." She stuck out her hand. We shook it. "We will be talking more," she said. "It is good to be on the same side. Perhaps our descendants will find it good to be friends."

The springer glowed gray behind her—she probably had some direct brain link to operate things like that—and she walked through, leaving us to our thoughts.

I could tell things were stirring in Shan, but I was too busy with my own thoughts, struck dumb, even in the confines of my shared skull, by a sudden awe.

Tens of thousands of copies of the cybersupremacists had endured DD . . . often compared with boiling alive, or the death of a thousand cuts, or injection with a fast-moving brain-destroying prion—and none of them had talked. To protect aintellects with whom they

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were in bitter dispute.

I found myself thinking, too, of a long-ago drunken night when Shan and I had gradually torn a bar apart, battering the robots with empty wine bottles and deliberately inflicting pain on them, because we were "just blowing off steam."

It was as if we had been a pair of cruel little boys pulling the wings off flies, only to learn that the flies were braver and better than we could ever hope to be.

I became aware of Shan's consciousness again; he was reeling as much as I was—no, I realized, more.

A few times in my adult life I had suddenly thought about a sad moment from my childhood and realized that Dad and Mother had had excellent reasons for the things they had done that had seemed so pointless and hurtful when I was seven, or ten, or fifteen. When, for a while, in a new body, Dad had been part of the agent-team I had led for the OSP, I had been astonished to discover how ordinary and human he was.

Once, on Briand, the only planet humanity had ever lost to mutual genocide, I had been the good friend of a genuine saint, and not realized how much he had to teach me until he was gone; I had thought of him as an ordinary loose-cannon local politician.

It felt like watching a serious accident inside my head. Stage by stage, I followed the swift flurry of thoughts that had made Shan utterly inarticulate.

He had seen how brave and loyal the utterly wrong-headed cybersupremacists had been; and then the generosity and courage of the aintellects of Union. I had seen the same things.

I had merely been astonished and ashamed to realize that the aintellects' many-orders-of-magnitude greater mental powers, and the control and precision of their emotions, allowed them to be, not just smarter than we were, but more virtuous and moral, in the same way that a human being can learn that it is wrong to steal and soil food from the table and to torment small animals, but a cat cannot. But I had never known any aintellect or robot well (except, I thought guiltily, the aintellect component of Azalais—but I hadn't known that while I knew her).

But until he was five, Shan's best friend had been an aintellect.

One on which he had depended. One he had betrayed—however little he understood the consequences. And that betrayal had meant death, probably death very much like being DDed.

And all these years, Shan had stayed sane about it with two barriers . . . that that aintellect had been somehow less than he was, because it was his servant; and that that aintellect had failed him. (rather than that he had betrayed it). The little boy who had lost his parents and could mourn them had spared himself the pain of having destroyed his best friend, by thinking of his best friend as something less.

No more. I finally made sense of the wail in my brain, the too-painful-to-ignore feeling I had been trying to trace. It wasn't words, or a picture, or even a physical sensation; it was the terrible emptiness of a place on the belt where a fist-sized ovoid of pink plastic would never be again.

I sat and let the tears roll down our face a long time, and when Shan had retreated into dull agony, I got up, fetched the guitar from its rack, and began to play. After all, he was in this body and music was how this body was used to getting feelings out.

Then something clicked, and I ran through a few chords as I thought about a melody, picked that melody, and began to sing softly,

One-one day, snow melts away,
But the sky is muddy gray . . .

I didn't really expect it, but he joined in, and if at first it was a little chokey and teary, by the fourth time through, in my own vocal cords, I could hear someone who might finally get to be a real big boy. ■

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Worlds Enough

Joel Davis

The solar system is bigger and less sharply defined than you may have thought.

In 1930—the same year that a science fiction magazine later known as *Analog* began publication—a 22-year-young astronomer named Clyde Tombaugh spotted our solar system's ninth planet, Pluto. Seventy-five years later, it's clear that Tombaugh discovered not just the ninth planet. He unknowingly found the first known member of an entirely new family of solar system objects: the Kuiper Belt, the source of so-called short period comets and what planetary scientist and Kuiper Belt expert Dr. S. Alan Stern of the Southwest Research Institute in Boulder, Colorado calls "the solar system's attic."

The first object to be unambiguously identified as a member of the Kuiper Belt was found in 1992. There had been hints and allegations long before then; Tombaugh's discovery, for example, falls into that "if only we'd known . . ." category. But the discovery of 1992 QB_1 by astronomers David Jewitt and Jane Luu was unmistakable, and was followed by more discoveries, more questions, and more surprises. Our understanding of the solar system has been undergoing a true revolution. It's now clear that the outer solar system is home to billions and perhaps trillions of small worlds, ranging in diameter from a few kilometers to the size of the planet Pluto. And perhaps even larger.

Today nearly a thousand objects have been discovered beyond Neptune. Collectively they're referred to as trans-Neptunian objects or Kuiper Belt objects (KBOs). All that we know about these new worldlets we've learned from afar, with telescopes and the sophisticated instruments attached to them. It's been enough to give us a first-order picture of this remarkable—and mysterious—region at the far edge of the solar system. What we need now (obviously!) is a visit to the Kuiper Belt with a dedicated space probe—a Pioneer or a Voyager. And now there is one: the New Horizons

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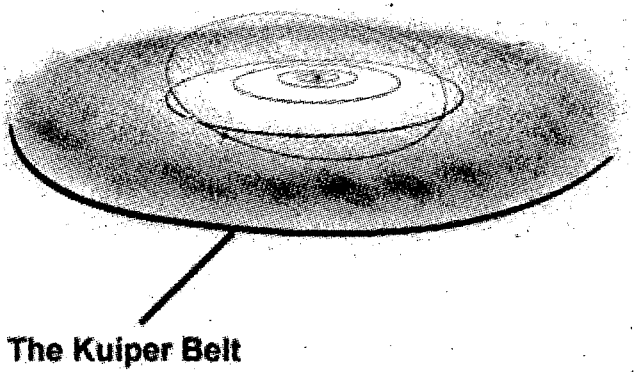

Location of the Kuiper Belt. The tilted orbit is that of Pluto.
Illustration courtesy of Applied Physics Laboratory, Johns Hopkins University

Pluto-Kuiper Belt mission.

Whose Idea Was This?

The first detailed published speculations about a cometary reservoir beyond Neptune were made by Irish amateur astronomer Kenneth Edgeworth in an article published in 1943. In an article published in 1949 Edgeworth reiterated his speculations. Meanwhile, the Dutch-American astronomer Gerard Kuiper was also wondering about the possible existence of objects beyond Pluto. In 1951 he wrote a book chapter[1] that included his speculations about the origin of short period comets. These are comets with orbital periods less than 200 years, and with orbits having inclinations[2] close to the plane of the solar system. Like Edgeworth, Kuiper believed that the apparent "sharp edge" of the outer system at Pluto couldn't be real. What better place, Kuiper reasoned, for short-period comets to come from? He suggested that Pluto's massive gravitational pull[3] would occasionally jostle a proto-cometary snowball out of its distant orbit, sending it plunging sunward. The hypothetical comet nursery was eventually named for Kuiper, mainly because he was better known in the astronomical community and more widely published.

But in the 1950s there was no way to prove Kuiper's and Edgeworth's hypotheses about a cometary reservoir beyond Neptune or Pluto. Not even the largest telescopes with the most sensitive cameras and photographic plates could ever image such tiny objects at so a great distance. The Kuiper Belt would remain an untestable and unconfirmed

[1] The book was *Astrophysics; a Topical Symposium Commemorating the Fiftieth Anniversary of the Yerkes Observatory and a Half Century of Progress in Astrophysics*, published by McGraw-Hill and edited by J. Allen Hynek (the same J. Allen Hynek who later became famous—or infamous—for his connection to UFOs and Project Bluebook).
[2] Orbital inclination (symbolized with *i*) is measured in degrees with respect to the plane of the ecliptic, which is defined by the plane of the Earth's orbit.
[3] At that time astronomers still believed that Pluto was a rather large and massive planet.

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hypothesis for another four decades.

Hints and Allegations

Even before Edgeworth and Kuiper first suggested the existence of a belt of comets-in-waiting beyond Neptune, there were hints that the trans-Neptunian region contained more than just empty space:

Triton. Neptune's first known moon, discovered in 1846, follows a retrograde orbit (it moves clockwise around Neptune as viewed from above). It's dynamically impossible for moons in retrograde orbits to form in the same region as their planet, so Triton must be a captured body.

Nereid. Neptune's second known moon (discovered in 1949 by Gerard Kuiper!) has a highly elliptical orbit, and is also a body captured gravitationally by Neptune.

Pluto. The ninth planet has the most eccentric[4] orbit of any planet in the solar system. At times Pluto is closer to the Sun than Neptune, most recently from 1979 to 1999. Its orbit is also inclined to the plane of the solar system by a whopping 17.2 degrees. Equally intriguing, Pluto's in a 3:2 *mean-motion resonance* with Neptune. This curious gravitational interaction means that for every three orbits Neptune makes, Pluto makes two. Finally, Pluto turned out to be much too small (2,320 km in diameter, smaller than Earth's moon) to cause the apparent oddities in Neptune's orbit that had led to the search for a "Planet X" in the first place.

2060 Chiron. Discovered in 1977 by Charles Kowal and named for the mythical Greek centaur, Chiron was originally thought to be the first known object in an asteroid belt between Saturn and Uranus. But its orbit turned out to be quite weird, taking Chiron from a perihelion[5] just *inside* Saturn's orbit to an aphelion just inside the orbit of Uranus. This is not a stable orbit over the age of the solar system; Chiron could not have originally formed in this region. Computer simulations showed that within a few million years Chiron will pass so close to Saturn that its orbit will be severely perturbed. Several years after its discovery Chiron began showing cometary activity, and many astronomers now consider it to be a really huge cometary nucleus rather than an asteroid.

Charon. Named for the ferryman of Hades in Greek mythology, Pluto's only known moon was discovered in 1978 by astronomer James Christy of the U.S. Naval Observatory while examining photos of Pluto. Charon is about 1,272 km in diameter, a bit less than half that of Pluto. The two are gravitationally locked, each keeping the same face to the other. Because of that and their similar sizes, some astronomers consider Pluto and Charon as a double planet. Others consider it the first Kuiper Belt object discovered—long before anyone even knew of the Kuiper Belt's existence!

The flybys of the outer planets (Jupiter, Saturn, Uranus, and Neptune) in the 1970s and 1980s by Pioneer 10 and 11 and Voyager 1 and 2 revealed a wealth of new information about those planets. In the process, the space probes discovered new moons circling those distant gas giants and revealed astonishing new information about many of the previously known moons. They also revolutionized our understanding of Saturn's ring system, discovered ring systems encircling Jupiter and Uranus, and ring arcs around Neptune. But these probes did not resolve the question of the Kuiper Belt's existence.

[4] Eccentricity is a measure of how far an orbit is from circularity. The less eccentric an orbit, the closer it is to a perfect circle; the more eccentric, the more elliptical the orbit

[5] Perihelion is the point on an object's orbit closest to the Sun. Aphelion is the point on the orbit furthest from the Sun.

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Meanwhile, special computer chips called charge-coupled devices (CCDs) had begun a revolution in Earth-based astronomy by replacing traditional photographic film. CCDs convert as much as 90 percent of the light falling on them into an image. Standard photographic plates are 10 percent efficient at best. Early CCDs had very narrow fields of view, much narrower than standard photographic plates. But the field-of-view gap narrowed considerably as the technology matured. Astronomers, both professional and amateur, began discovering new planetary satellites, comets, and asteroids, including small asteroids in Earth-crossing orbits. As the twentieth century drew to a close, the solar system was looking a lot more crowded than it had when Clyde Tombaugh discovered Pluto. Soon it would turn out to be not only more crowded, but a whole lot bigger.

Jewitt and Luu and 1992 QB_1

In 1987 David Jewitt, then an assistant professor at MIT working in planetary astronomy, began looking for distant objects in the solar system, with the assistance of graduate student Jane Luu. Their initial searches used then-standard astronomical technology—telescopes and photographic plates. They repeatedly photographed large areas of the night skies in both the northern and southern hemispheres, then spent tedious hours comparing the images using a blink comparator, "blinking" first one plate and then the other to see if anything "moved." This was the same technique and the same kind of machine that Tombaugh had used to find Pluto in 1930. They were unsuccessful, so they tried the new CCD technology, using another telescope at Kitt Peak and a CCD chip with a very small field of view. The results were the same.

The two pressed on, though, continuing their search for objects beyond Neptune. They had a new base of operations: the Institute for Astronomy at the University of Hawaii, with its access to the world-class cluster of telescopes atop Mauna Kea. Other groups began looking as well. Between 1989 and 1991, several teams of astronomers at various other institutions tried and failed to find distant solar system objects. As did Jewitt and Luu. But CCD technology was improving by leaps and bounds. Larger and more sensitive chips became available, and Jewitt and Luu took full advantage of them.

On the night of August 30, 1992, they hit pay dirt. Using a 2.24 m telescope on Mauna Kea, they spotted an object that seemed to move as they blinked two successive images of the same part of the sky. Additional observations in the following weeks verified their discovery: a tiny planetesimal[6] in an orbit beyond Neptune, and it was officially announced in September. The Minor Planet Center in Cambridge, MA, which keeps track of these things, gave the object the preliminary designation 1992 QB_1. We now know that 1992 QB_1 is a fairly small body, probably about 200 to 250 km in diameter assuming an albedo or surface reflectivity of 0.04 (similar to a cometary nucleus). Its orbit has a semi-major axis[7] of 43.7 AU[8], with perihelion at 40.9 AU (about 1.6 billion kilometers beyond Neptune) and aphelion at about 46.6 AU. It has an inclination of 2.2 degrees and a minuscule eccentricity of 0.065. 1992 QB_1 appears to be a rather typical classical Kuiper Belt object.

The Borderland of Sol

Almost a thousand planetesimals belonging to the Kuiper Belt have been dis-

[6] Small bodies formed in the early solar system by accretion of dust and ice.

[7] The average distance from the object to its primary, such as a planet or comet from the Sun.

[8] Astronomical unit, the mean distance from the Sun to the Earth, about 149.6 million km.

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The largest known objects in the Kuiper Belt

Name/Designation	Diameter (km)	Semi-major axis (AU)	Discovered
Pluto	2,320	39.4	1930
90482 Orcus	~1,600	45	2004
Charon	1,270	39.4	1978
90377 Sedna	1,000-1,500	532	2004
50000 Quaoar	1,000-1,400	43.25	2002
55636 2002 TX300	~965	43.19	2002
55637 2002 UX25	~910	42.71	2002
28978 Ixion	890-1,220	39.39	2001
20000 Varuna	860-1,260	43.23	2000
55565 2002 AW197	770-1,010	47.52	2002

covered since 1992, and astronomers have steadily gathered basic information about them. The data acquired so far are giving planetary scientists new insights into the formation and evolution of the solar system's outermost regions. This is the area that science fiction writer Larry Niven once called "The Borderland of Sol."

How was the Kuiper Belt formed? Alan Stern is serious when he calls the Kuiper Belt the solar system's attic. For many of us, the attic of our house is a convenient storage space. It's where we toss all the stuff that we're not using and don't have a place for in the living room, bedroom, or even the closets. So up it goes, and out of sight.

The same appears to be true of the Kuiper Belt. The solar system formed 4.7 billion years ago from a disk of dust, ice and gas. Dust and ice particles stuck together, soon growing large enough for their gravitation to begin pulling in still more material. Planetesimals closer to the infant Sun were mostly rock, and soon merged into the four inner terrestrial planets. Much further out, planetesimals composed of both rock and ice grew. Several became huge—the infant Jupiter, Saturn, Uranus, and Neptune. In the region now occupied by Uranus and Neptune, planetesimals would have formed mostly from dust and ices of water, methane, and other simple organic molecules. These primordial objects would have soon settled into slightly elliptical orbits on the plane of the solar system.

Within a few million years, Jupiter had become massive enough for its gravitational field to exert a powerful influence on the evolving solar system. Computer simulations show that Jupiter's gravity would violently disrupt the orbits of planetesimals within its region of influence. Some would be thrown farther inward; others would be flung entirely out of the solar system. And still others would be tossed into orbits taking them dozens and even hundreds of AU from the Sun.

More important for the Kuiper Belt, though, was the formation of Neptune. Other computer simulations indicate that Uranus and Neptune may have formed closer to the Sun than they are today. As their gravitational fields threw planetesimals inward towards Jupiter, they slowly spiraled outward (an example of Newton's Third Law). As it did so, Neptune's gravitational field in particular affected the orbits of many planetesimals in the regions beyond its original location. Some became trapped in orbits affected by mean-motion resonance with Neptune; others were tossed even further outward. And some remained mostly where they were, but in orbits with greater eccentricity or inclination

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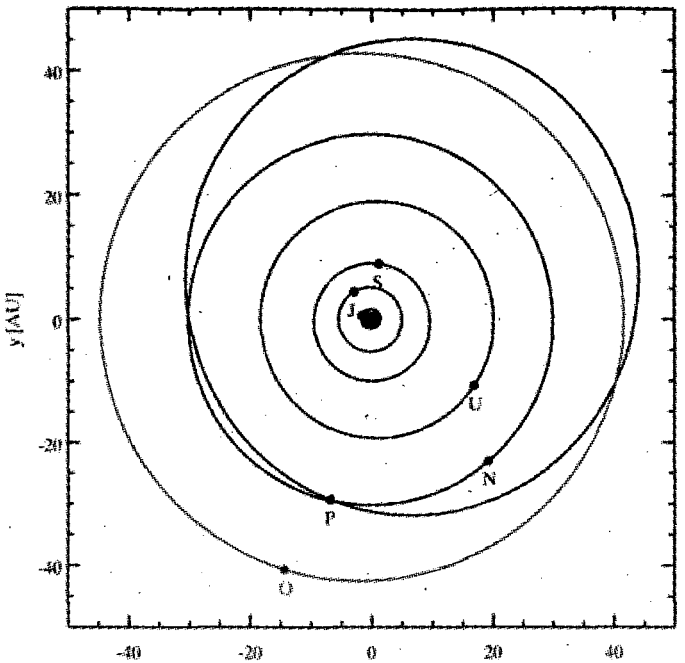

Orbit of Quaoar, a classical KBO.
Illustration courtesy of Chad Trujillo, Gemini Observatory

that before.

This is a fairly simplified picture of the Kuiper Belt's formation—a confusing and chaotic time in the solar system's early history. There are still many puzzles that await resolution. For example: Why does the Kuiper Belt have a fairly sharp boundary at about 50 AU? Is it a real edge, or merely a dip or "trough"? What creates the Kuiper Belt's dynamic structure?

What does the Kuiper Belt look like? Astronomers generally agree that the Kuiper Belt has three main structural components: the classical Kuiper Belt, a scattered disk, and an extended scattered disk.

The *classical Kuiper Belt* stretches from Neptune's orbit (about 30 AU) to a fairly sharp boundary at about 50 AU from the Sun. This appears to be real; it corresponds closely to the 2:1 mean-motion resonance point with Neptune, the strongest gravitational resonance at that distance. "This might be because the radial migration of Neptune shoved preexisting disk objects out that far and no more," says Jewitt. "The edge could also be caused by tidal truncation from a passing star or conceivably from a distant, unknown 'planet'" or planet-sized KBO.

The vast majority of KBOs found so far are in this region. Orbits in the classical Kuiper Belt are stable over the age of the solar system, mainly because their perihelia are far enough from Neptune that its gravity can't scatter or disrupt them. About 10 to 25 percent are called *Plutinos*; like Pluto, they're in 3:2 mean-motion resonance with Neptune. Other KBOs are in orbits with different resonance relationships with Neptune. "I consider them a sub-population of the

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classical belt," says Brett Gladman of the University of British Columbia, the discoverer or co-discoverer of many KBOs. Jewitt considers them to be a separate component of the Kuiper Belt. "Resonant objects are clearly a stand-out group on plots of semi-major axis versus eccentricity," he says.

The objects in the classical Kuiper Belt have fairly circular orbits with semi-major axes from 35 to 56 AU, and form a region that looks like a doughnut. Some KBO orbits have a relatively high inclination or eccentricity. Within that doughnut is a region of orbits with low inclinations and low eccentricity. Gladman has referred to this latter region as the "dynamically cold component" of the classical Kuiper Belt, and the more inclined or eccentric orbits the "dynamically warm region." ("Cold" and "warm" refer to the relative mean random energy of orbits in each population, as if the KBOs were particles in a gas.) For reasons still unknown, the KBOs in dynamically warm orbits are grayer or more neutral in color, while those in the dynamically cold orbits are reddish in color. The problem is, there shouldn't *be* any dynamically "warm" component in this region; the orbits should have retained their low eccentricity and inclination for the age of the solar system. So something "stirred up" the classical Kuiper Belt early in its history, jostling some objects into dynamically warm orbits.

"We still don't know for sure what causes the correlation between inclinations and colors," says Chad Trujillo, a co-discoverer of several of the largest KBOs found so far. He thinks the two components may be two populations of KBOs superimposed on one another. "I think it's pretty easy to imagine that some inner solar system interlopers"—Gladman's dynamically warm group—"could have been superimposed onto the older, redder core population that formed beyond Neptune," he says. Trujillo also makes a sharper distinction between "the classicals" and "the resonant" KBOs, which he says "almost all [have orbits] quite a bit more elliptical than the classicals."

Other possible reasons for the dynamically warm component include those invoked to explain the sharp edge to the classical Kuiper Belt—

A planetesimal the size of Pluto or Mars passed very near or through the Kuiper Belt.

Another star passed within 50 to 200 AU of the outer parts of the Kuiper Belt during the early eons of the solar system.

As Neptune slowly migrated outward from its original location closer to the Sun, its mean-motion resonance regions disrupted the inclination of KBO orbits beyond Neptune.

The *scattered disk* is a region of KBOs with orbits that are highly eccentric, have large semi-major axes, and perihelia at around 35 to 40 AU, relatively near Neptune's orbit. Their aphelia are *way* out there: from several hundred to 3,000 AU distant.

The orbits of the scattered disk objects (SDOs) are stable on billion-year timescales, but their perihelia mean they do have a weak gravitational interaction with Neptune. In fact, that's probably why scattered belt objects are scattered. Repeated encounters with Neptune would send some of them deeper into space and pull others into orbits taking them closer to Neptune, Uranus, and the outer planets.

Finally, we should mention the Centaurs, defined as objects like 2060 Chiron with perihelia in the realm of the giant planets Jupiter and Saturn. Centaurs are *not* part of the scattered disk now. Says Gladman, "They have semi-major axes that are less than 30 AU, and spend most or all of their time within Neptune's orbit." But they may have originally come from the scattered disk, tossed further inward by coming too close to Neptune.

The *extended scattered disk* includes

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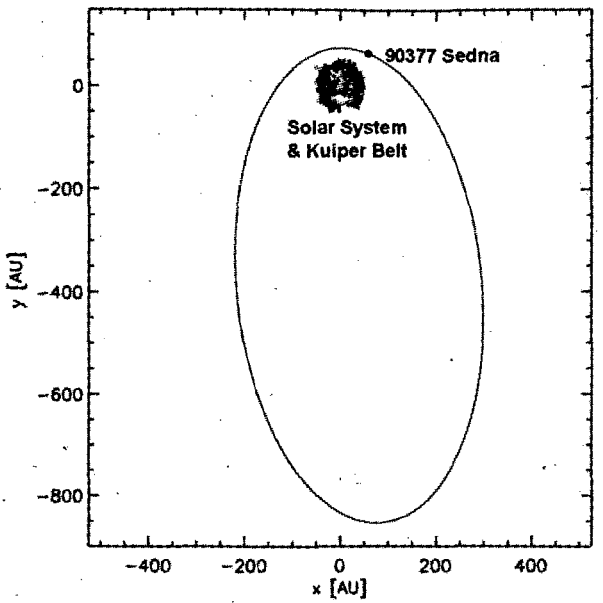

Orbit of Sedna, a KBO that may actually be the first discovered member of the Oort Cloud.
Illustration courtesy of Chad Trujillo, Gemini Observatory

KBOs with large semi-major axes, large eccentricities, and with perihelia *greater* than 38 AU. These objects never come close enough to Neptune—"the big boy out there," says Jewitt—for their orbits to be jostled or distorted by its gravitational field. There are only two KBOs currently known to be part of the extended scattered disk, 90377 Sedna and (possibly) 2000 CR_{105}. Orbits in the extended scattered disk are stable over the age of the solar system. But that also means that their orbits could not have been created by mean-motion resonances with Neptune. Some other force or forces must have put these KBOs in these orbits.

"People have successfully made models using a close stellar passage to create such orbits," says Trujillo, "so I would say it's a valid explanation. A Mars-sized body at around twice the distance to Neptune might also make such a body but I don't think anyone has modeled this case. A close stellar passage is the best explanation so far, but I think it's still much too early to say for sure."

Beyond the extended scattered disk is the inner region of the Oort Cloud. First postulated by astronomer Jan Oort in 1950, the Oort Cloud is the source of long period comets, which have orbital periods greater than 200 years and enter the inner solar system from every part of the sky. The Oort Cloud is thought to consist of an inner flattened region that ranges from 1,000 to 5,000 AU, and an outer spherical region that stretches out to 50,000 or even 100,000 AU—a third of the way to the nearest star.

"The observational difference between the extended disk and the inner Oort cloud is a subtle one," says Alan Stern. "It's more semantic than anything; they probably blend into one another. As we learn more about KBOs we can determine which population they belong to by their physical characteristics.

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We can't really distinguish yet from their orbits alone."

What are KBOs made of? KBOs are so distant and small that determining the *exact* composition of their surfaces and interiors is quite difficult. Astronomers instead gather information on the surface colors of KBOs, and then make informed guesses about their composition. KBOs range in color from somewhat neutral (gray, that is, reflecting all wavelengths more or less equally) to very red. The reddish KBOs may be covered by large areas of tholins, polymers formed when ultraviolet light strikes simple organic compounds like ethane and methane. Or, they may have the kind of blackened crusts seen on some comet nuclei. The more neutral-colored objects may have more ices on their surface. Collisions with other objects dig craters in dark, crusty surfaces and throw up fresher icy material, including water, carbon monoxide, carbon dioxide, and methane ices. Some of the larger KBOs may even have active ice volcanoes like Triton. The basic belief among planetary scientists is that most KBOs are probably made of various kinds of ices mixed with dust and some organic material. In this respect KBOs appear to have much the same composition as comets—an argument consistent with the Kuiper Belt as the source of short period comets.

How big are they? There are at least a half-dozen known KBOs that may be a thousand kilometers or more in diameter. The largest are 90482 Orcus (up to 1,600 km in diameter), 90377 Sedna (1,000-1,500 km), and 50000 Quaoar (1,000-1,400 km). And there likely are a lot more big ones out there.

"There are probably a hundred thousand Kuiper Belt objects that are a hundred kilometers or more in diameter," says Stern. "There are at least dozens of objects—and maybe as many as a thousand—that are half the size of Pluto or bigger." That's as many as a thousand Charons, and Sednas, and Quaoars. But wait, says Stern; there's more. "I'm a hundred percent sure in my bones that there's a least one Pluto- or Mars-sized object in the Kuiper Belt. And I'd say there's a fifty percent chance that there's one Kuiper Belt object the size of Earth."

Trujillo agrees with this assessment, but adds, "I bet that if there *is* a Mars-sized KBO, it is probably very distant. I would be very surprised if it were, say, within 50 AU and we didn't know about it already."

And smaller ones? Estimates range into the billions.

New Horizons

Pluto is the only planet not visited by a space probe from Earth. And no one even knew for sure that the Kuiper Belt existed until 13 years ago. Planetary scientists have wanted to send a spacecraft to Pluto since the 1970s. Now, after years of ups and downs, cancellations and resurrections, a spacecraft from Earth is about to journey to the borderland of Sol. Its primary target: Pluto and Charon. Its secondary target: one or more Kuiper Belt objects. The mission is named New Horizons Pluto-Kuiper Belt. At the time this issue of *Analog* went to press, it was ready to be launched during a 36-day window beginning January 11, 2006 from Cape Canaveral atop an Atlas V booster.

New Horizons has a mass at launch of about 465 kg, with on-board power provided by the same kind of plutonium-powered radioisotope thermal generators used by the Voyagers, Galileo, and Cassini-Huygens space probes. The spacecraft carries seven scientific instruments, including cameras, spectrometers and radio science experiments. One instrument worth special mention is the Student Dust Counter (SDC), the first instrument designed and run by college students to be carried on a planetary space probe. Alan Stern is the principal scientist for the New Horizons mission.

New Horizons will stretch spacecraft

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New Horizons Primary Instrument Uses

Name	Instrument Type	Primary Uses
Ralph	Imager/Imaging spectrometer	•Panchromatic photometric/ geologic mapping (1 km resolution) •3-color and CH4 mapping (3 km resolution) •Composition mapping (7 km resolution) •Thermal mapping (2-20 km resolution)
Alice	UV imaging spectrometer	•Atmospheric composition •Upper atmosphere pressure & temperature profiles
REX	Radio science, radiometry	•Lower atmosphere pressure & temperature profiles •Disk averaged brightness temperatures •Masses, J2s
LORRI	High-resolution imager	•Pluto far-side mapping (35-40 km resolution) •High-resolution geology (50 m resolution) •Distant/early start to encounter imagery (5x farther than Ralph)
SWAP	In situ plasma spectrometer	•Atmospheric escape rate
PEPSSI	In situ particle spectrometer	•Pickup ion composition
SDC	In situ dust counter	•1st solar system dust density profile beyond 18 AU

engineering to new limits. This is a *long* mission! After a cruise phase of about 13 months New Horizons will fly by Jupiter and its system of moons and rings, from February 25 through March 2, 2007. The flyby will give New Horizons a gravitational boost for its journey to Pluto and beyond.

Then it will cruise. For another eight years. Most of this time New Horizons will slumber, waking occasionally so its handlers back home can make sure its systems are still working normally.

In 2015 New Horizons will make its historic flyby of Pluto and Charon. Ten weeks before flyby the spacecraft's images of Pluto and Charon will exceed the best possible resolution achieved by the Hubble Space Telescope. Daily observations will begin about four weeks before closest approach. And if all goes well, New Horizons will make its flyby of Pluto-Charon on July 14, 2015, passing within 11,000 km of Pluto and about 27,000 km of Charon at a velocity of about 14 km per second.

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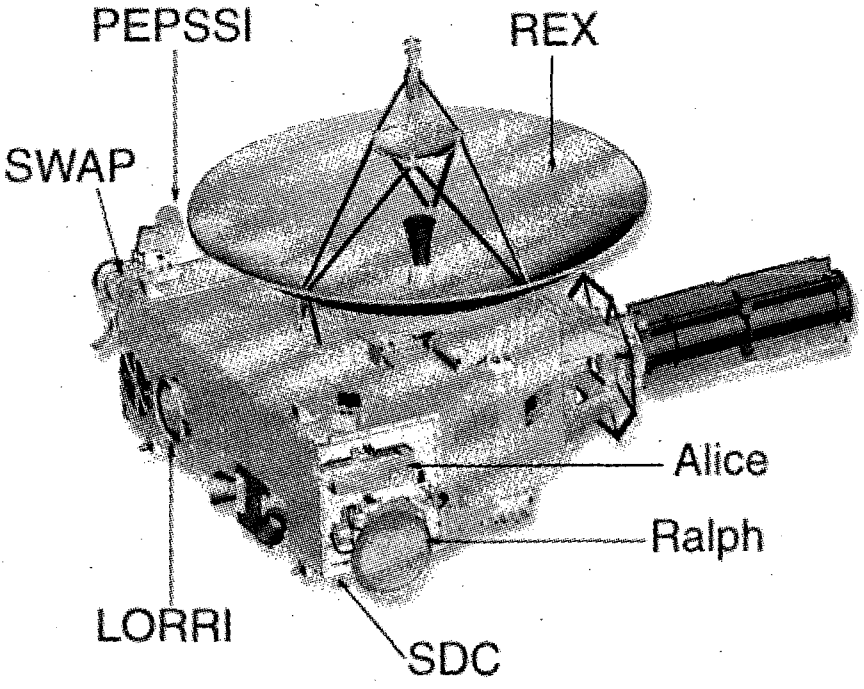

The New Horizons spacecraft, with major instruments labeled. "Ralph" and "LORRI" are the imaging instruments.
Illustration courtesy of Applied Physics Laboratory, Johns Hopkins University

Even before the spacecraft reaches Pluto, astronomers will find candidate KBOs for the extended mission. "We don't want to pick a KBO target until as late as possible," says Stern. He likens it to planning to take a trip to France in 2015 and eating dinner at a Parisian restaurant. Between now and 2015, thousands of new restaurants will open in Paris. So you don't pick a restaurant today; you wait until 2015 to make reservations.

Location is also important. "We need to find a KBO behind Pluto and a little to its left or right," explains Stern. "Like shooting skeet, you have to find it and lead it." After the Pluto flyby, New Horizons will still have enough maneuvering fuel for course changes that can get it to KBOs within its "trajectory cone." Stern plans to do the search between 2011 and 2013 using the Keck and Subaru telescopes. They'll look for KBOs in the right place out to 55 AU and choose one or two finalists from a short list of about a half dozen. Two weeks after the Pluto encounter New Horizons will carry out a trajectory change maneuver—a "burn"—that will aim it towards its first Kuiper Belt minor planet.

After the Pluto flyby New Horizons will cruise again, for about one to three years. The first KBO flyby could occur as early as 2016 or as late as 2019. The spacecraft will take some optical navigation images of the target KBO about four or five weeks before the flyby. With that information, flight controllers on Earth will have the spacecraft make an additional burn to put it on its final path.

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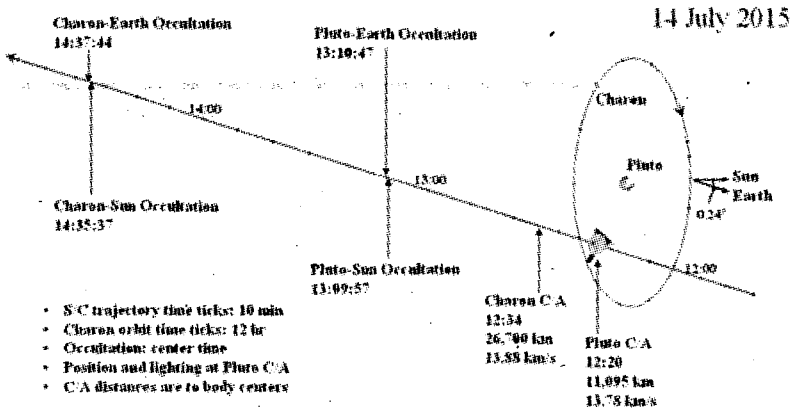

New Horizons' path through the solar system from Pluto through KBO encounters.
Illustration courtesy of Applied Physics Laboratory, Johns Hopkins University

New Horizons should fly past its target at a velocity of between 8 to 14 km per second, possibly as close as 3,000 km.

And what will New Horizons see? What information will it glean from the quick encounter with a tiny, icy Kuiper Belt object in the distant regions of the solar system? We will probably learn much more about the shape, composition, size, geology, and mass of a KBO than we've ever known before. And, we should remember this: Every—*every*—flyby we've carried out has revealed stunning surprises about the planet, moon, asteroid, or comet encountered. Without exception.

So when we finally get our first up-close look at Pluto and then a Kuiper Belt object, when we first stare at a chunk of matter left over from the formation of the solar system, we should expect surprises.

We should expect to see something . . . astounding. ■

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The Skeekit-Woogle Test

Carl Frederick

Where is the line between a disease and a gift?

"Imagine," said Kendrik, "a language that has the word skeekit and also the word woogle." Standing in front of his boss's desk, data-tablet in hand, he paused. He hoped the man would invite him to sit, but Victor merely stared with his usual mixture of boredom and condescension.

"Why should I imagine it?" Victor said. "Does this have anything even remotely to do with epidemiology?"

"I believe we're on the verge of a pandemic." Nervously, Kendrik cast his gaze around the trophy office before bringing them to rest on his data-tablet. "On the basis of *epidemiological* evidence"—Kendrik raised his head to meet the section chief's eyes—"I believe we're in the midst of an epidemic of synesthesia."

"Of what?"

"Synesthesia. The most common form is 'colored hearing.' Music perceived as having colors, or a particular word having a particular shape. That sort of stuff. A cross-wiring of the senses."

Victor leaned back in his plush executive's chair, clasped his hands behind his neck, gazed up at the ceiling for a few seconds, then shook his head. "No. That's a mental condition, not a disease." He scowled. "Pandemic, indeed."

"Jeffert's Paranoia is caused by a virus," said Kendrik. "This could be, too."

"I doubt it."

"The contagion model is a good fit."

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Kendrik tapped his data-tablet. "And, in its early stages at least, it's exceptionally common."

Victor snapped upright. "Well, I don't have it."

"Maybe you do. Take the skeekit-woogle test and find out."

"The what?"

"Just a simple question and answer."

Victor let out a sigh and pointed to a chair. "All right, fine. But quickly, please."

"Okay." Kendrik sat. "Skeekit and woogle. One word means a hard-boiled egg, and the other means a shard of broken glass." He slid forward on the chair. "The test is to tell me which word means what."

"It's obvious," said Victor without pause. "A woogle is the egg and a—what is it?—a skeekit is the shard of glass."

"Well, there you go, then." Kendrik smiled. "You've passed the SW test. I'm afraid you've caught a case of synesthesia. You're identifying the sound of a word with a shape."

"I don't buy it." Victor shook his head. "Everyone would pass that test."

"I didn't."

"Really?" Victor raised his eyebrows, then smiled. "You data miners just have no imagination."

Kendrik bristled. "Which is good. I deal in facts."

"All right, all right." Victor crossed his hands on his desk. "Give me facts about this disease of yours."

Kendrik didn't think Victor was really interested, but was just trying to make amends for the "no imagination" comment. "Well, you're right. Almost everyone has it in some form." He activated the tablet. "I've run Deep Miner and it shows a rapidly growing incidence of synesthesia among the general population." He read aloud some of the findings. "The condition in its severe manifestation correlates with dyslexia, left-handedness, enhanced imagination and creativity, superior memory, poor sense of direction, left-right confusion. It develops in the limbic system and the hippocampus, and it is a potentially fatal condition."

"What was that?" Victor unclasped his fingers and jerked forward with an alert expression. "Did you say fatal?"

"That's what Deep Miner yielded."

"How long?" said Victor. "What's the duration from onset to death?"

"Um." Kendrik fidgeted, focusing on the data-tablet. "Well, DM projects, um, about 300 years."

"What?" Victor raised his eyebrows. "Did you say 300 years?"

"That's what DM says."

"Would you mind telling me," said Victor, clearly stifling a laugh, "why should we care about a disease that might kill us way after we're already dead?"

"I don't know." Kendrik shrugged. "Aesthetics?"

"The federal government," said Victor, archly, "is not paying us to study the aesthetics of disease." He shook his head, his brow furrowed. "I can't believe DM ranked this a disease," he said, softly, almost to himself. He rubbed his chin then glared at Kendrik. "What was the confidence factor?"

"Fifty-three percent."

Victor pounded a fist on the desk. "You're basing this on a mere 53 percent?"

"And also on my interpretation of the data."

"Interpretation?" Victor pounded the other fist. "Look. If I wanted interpretation, I'd have hired a . . . a . . ." Victor made soft grunting noises.

"A Tarot card reader?" said Kendrik, hoping that by finishing the sentence, he could calm his boss.

Victor cast a fleeting glance to the ceiling, then let out a long breath. "A year out of college," he said. "Young and eager. I admire your zeal, but—"

Kendrik stood. "Look. I know you don't believe any of this. And DM says that's one of the symptoms—denial:

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thinking everything's fine."

Victor looked up at him. "Are you saying one of the symptoms is denying there's a symptom?"

"Well, yeah." Kendrik pawed a shoe against the plush carpet. "Maybe it's a survival trait of the bacterium that causes the disease."

"So, it's a bacterium, now."

"Or a virus. Or a prion, maybe."

"I don't buy it." Victor gave a sharp snort. "Hard to debate the issue when the mere fact that I'm arguing proves your point." He stood. "Look, Kendrik. I can't do anything without evidence, not even open a watch-file. You'll have to provide me with an example—a pod of advanced cases; a disease vector." He walked Kendrik toward the door. "That's reasonable, isn't it?"

"Yeah. I guess." Kendrik noticed Victor's bright, vibrant, new-car smell—a popular deodorant scent of late. But "vibrant" was hardly the word he'd use to describe his boss. Kendrik considered Victor the least imaginative man he'd ever encountered. *And if I'm dull compared to Victor, it's a wonder I can even get a phone to give me a dial tone.*

In his office, Kendrik glowered at the control monitor as he initiated Deep Miner, had it search for a concentration of the synesthesia disease, and set a trigger for a vector he could drive to. He had an ulterior motive.

While he waited for DM to do its work, he fumed. He hated to admit it, but Victor's "no imagination" comment galled. And, even though he liked to pretend to the contrary, it was probably on the mark; he was, simply, unimaginative. His mother had been an artist, a painter. But despite her prodding, and his being given paint sets on almost every birthday, her creative imagination had not been passed down to him. He couldn't paint a stroke.

But now, maybe he could do something about it. People with synesthesia were generally imaginative and creative. And Kendrik believed it was causal; synesthesia engendered imagination. All those people out there who could instinctively tell a woogle from a skeekit: *they* were creative—and just because they were lucky enough to contract synesthesia. Kendrik was determined to contract it as well. He knew he was a likely candidate: left-handed, lousy sense of direction, and even dyslectic.

"Geez," he said aloud. "I hunt diseases. You'd think I'd be able to catch one."

His computer beeped. Deep Miner had completed its "Inductive Reasoning" search of the nation's newspapers, newsgroups, and data networks. Kendrik peered at the LCD data-wall.

"Yes!" DM had found a pod of heavy synesthesiacs. Better still, the site was nearby—less than an hour drive away. Kendrik downloaded the driving instructions to his car and then did a simple net search for information about the pod—The Canvas Cooperative.

The coop, he discovered, was a residential facility for artists—mainly painters of large works. As he scanned the search results, one entry all but leapt out at him. He whistled, scarcely able to believe his luck; the Canvas Cooperative had biweekly open-house parties, and there was one this very evening.

Kendrik leaned back, put his feet on his desk, and planned: To have the best shot at contracting synesthesia, he'd have to spend as much time there as he could. Maybe he could pose as an art connoisseur—a buyer for a museum, perhaps. He smiled. Even though he didn't have an artist's creativity, he could tell a Delacroix from a Gericault at twenty paces. His mother had seen to that.

He thunked his feet back to the floor. It was ridiculous, really—going to an artist colony in hopes of contracting creativity.

Still . . .

"Imagine a language that has the word skeekit and also the word woogle."

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"I'm not programmed to imagine," said the car.

"Just as well, maybe." Kendrik sat in the nominal driver's seat, watching out the window as his car drove him to the cooperative. *It would be rather demoralizing to find that even my car has more imagination than I do.*

"We're at your destination," said the car, slowing down. "Please assume manual mode for parking."

Kendrik disengaged "automatic," feeling the slight lurch as he took control, and eased the car into a curbside parking spot only a half block from the coop. He was surprised at how easy it was to find parking, especially since it was already eight o'clock—the announced start time for the party. But then again, artists weren't generally known for their promptness. He'd learned that often enough from his mother.

Kendrik said goodbye to his car and walked toward the door of the old brownstone. He wasn't wearing a tie. He felt naked without a tie.

At the door, Kendrik knocked and was admitted by an energetic man who looked to be in his early thirties.

"Welcome to the Canvas Cooperative." The man spoke in a heavy southern accent. "My name's Jacques." He shepherded Kendrik inside.

"Jacques?"

Jacques laughed. "Yes. From Tennessee, not Paris," he said, giving the French pronunciation to Paris. "I'm afraid my father's a francophile."

Walking into a cavernous, well-lit studio, Kendrik inhaled the layered, richly colored aroma of oil paints so familiar to him from his childhood.

A couple of large, incomplete paintings hung from the walls at a height low enough that they could be worked on in place. In the center of the studio, a table held little snacks, bottles of wine, and a decanter of a purplish liquid that was far too opaque to be wine. Kendrik would have thought they'd have genteel crystal stemware, but instead there were only mug-like drinking glasses. Kendrik smiled. Either the coop members were unconcerned about appearances, were extraordinarily clumsy, didn't have much money, or they all drank like fish.

Only six or seven people graced the room which could have easily accommodated thirty. Jacques explained that the stated eight o'clock start was a code; it was an absolute prohibition against arriving any earlier and an indication that anyone arriving in the first hour might be called upon to move furniture.

At the food table, Jacques offered a glass.

"Thanks," said Kendrik, noticing that Jacques was left-handed, "but I don't drink wine." He was embarrassed to tell the man that he didn't drink anything alcoholic.

"Do try it." Jacques forced the tumbler into Kendrik's hand. "The Riesling is exceptionally good. And you'll find it makes the canapés taste almost edible."

Kendrik chuckled, then pointed to the decanter. "That's a strange-looking wine."

"Borscht." Jacques nodded toward a distant canvas—an angular abstract rendered in bright colors. In front of the painting, a swarthy man stood contemplating it, his hands in the back pockets of his pants. Standing next to him was a slender woman with Asian features.

"Vladdy will drink nothing else," said Jacques. He pointed. "Vladimir Mussorgsky. That's him standing there admiring his painting. He's just come here from St. Petersburg—that's Russia, not Florida."

Kendrik reached for the decanter. "I'll try the borscht, then."

"A brave soul."

"And the young woman?" said Kendrik as he poured the dull purple liquid.

"Suki. She, Vladimir, and I are the resident managers here." Jacques waited until Kendrik had filled his glass. "Come. I'll introduce you." He clapped Kendrik softly on the shoulder. "Vladdy will be

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glad to see another borscht lover. By the way, do you paint?"

"My mother was a painter." Kendrik thought it better not to add that she hated abstracts. "But I don't." He took a swig of the borscht. "The creativity gene must have somehow not been passed down to me."

Jacques uttered a snort. "Creativity is a disease!"

"No, it's not," said Kendrik as they walked toward the huge canvas. "Synesthesia is the disease."

Jacques froze for an instant, like a teacher might do when struck in the back of the neck with a spitball. "Indeed," he said.

In front of the painting, Jacques made introductions, but he seemed distracted.

"Ah," said Vladimir, taking a hand from his pocket and extending it. "You drink borscht. Good! Wine is terrible!"

Laughing, Kendrik shook the proffered hand. "The drink of choice of the beet generation."

"Is true," Vladimir insisted. "Wine not even fit for cleaning brushes."

Kendrik nodded toward the painting. "Very nice," he said. "Somewhat reminiscent of a Kandinsky landscape."

"You really think so? Thank you." Vladimir glanced up at his work. "I call it 'Great Gate at Kiev.'"

"I see it," said Kendrik. "Close to full scale. Impressive." He took a deep draft of his borscht. "The painting has something of a skeekit flavor about it."

"Skeekit? *Shto eta*, skeekit?" said Vladimir, lapsing into what was probably Russian.

"As opposed to a woogle, that is."

"Ah. I see what you mean."

Kendrik looked down at his glass. "What is in this borscht?"

"Is simple. Just crushed beets, sour cream, and vodka." Vladimir shrugged. "And maybe little secret ingredient."

"Did you say vodka?"

"*Da*," said Vladimir. "Much vodka."

"Kendrik has just told me," said Jacques in a quiet voice, "that synesthesia is a disease."

Vladimir started visibly. "He knows of synesthesia?"

Kendrik felt something was going on. But then again, maybe it was just the borscht. Good borscht. Very good borscht. Kendrik felt himself begin to sweat.

Suki stared at him with an intense yet undecipherable expression. "Are you a painter?" she asked.

"No. I'm an epidemiologist with the Bureau of Disease Control." Inwardly, he winced. The sight of an attractive woman, and he completely forgot his cover story. "But my mother painted—oil and acrylic. Representational art."

"Representational art," said Vladimir with a scowl. "Oxymoron! That's what cameras are for."

Just then, a dog, a large shaggy Otterhound, padded in from an adjoining room.

"No, Oxy." Jacques pointed back the way the dog had come. "Go!"

A man appeared in the doorway. He called for the dog, and the Otterhound bounded back to the other room.

Kendrik smiled at Suki. "Are *you* a painter?" he asked.

"I paint with words." She smiled back. "The raw materials are much cheaper. Or so goes the saying."

"She is poet," said Vladimir.

"Epidemiologist," said Suki, thoughtfully. "It sounds like the middle line of a haiku."

"Synesthesia is disease?" said Vladimir, abruptly. He glowered at Kendrik. "Why you say that?"

"Maybe," said Jacques, "it's just that to an ax, everything is a tree."

"I don't understand," said Kendrik, conscious that he was slurring his words. He cleared his mouth with another dose of borscht.

"To a pen," said Suki, "everything looks like paper."

"No," said Jacques, a hint of harshness in his voice. "To a pen, everything looks like a pig."

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"Please?" said Kendrik.

"They mean," said Vladimir, "that to epidemiologist, everything looks like disease." He made a fist. "Why you interested in synesthesia?"

"A haiku," said Suki. She looked away, a dreamy expression in her eyes. "Sneezing in the wind, epidemiologist, propagates his quest."

"Who sent you?" said Jacques.

"What? Nobody sent me."

"Of course they didn't," said Suki. She turned to Jacques. "Let's not badger our guest." Then, smiling at Kendrik, she said, "Your glass is empty. Why not have some more of Vladdy's borscht—and mingle. Enjoy the art?"

"Yesh," said Kendrik. "Good idea."

Over the next few hours, Kendrik did enjoy the art. But he drank more than he mingled.

At the refreshment table, Kendrik felt his eyes go watery. "I wish I were creative," he said, grabbing on to the tablecloth for support. "It isn't fair. Why can't I have imagination?"

"I'm sure you're imaginative," said Suki. "Only an imaginative person would ever entertain the notion that he's unimaginative."

"You're creative, Suki." He pulled the tablecloth to steady himself, and an empty crystal cookie plate slipped off the table and bounced to the floor. "Whoopsie." His knees turned rubbery and again he grabbed at the tablecloth. Another plate became airborne. The second platter landed on the first, and shattered. Splintery shards of glass flew outward, showering the carpet with gemlike slivers of brightness.

As Kendrik looked down, admiring the shining rivulets against the sandy carpet, he began to fall. Hands caught him—Suki's and Jacques' hands.

"Careful," said Kendrik. "Don't step on the little woogles."

"Yes, yes," said Jacques. "We'll be careful."

Kendrik waved at everyone as he felt himself being carried out to another room.

He was conscious of being conscious—but of little else—as Jacques deposited him into a plush chair.

"He's as drunk as a moonshiner's dog," said Jacques, stepping back and looking at the man.

"But perhaps," said Suki, "*in borscht, veritas*."

"Maybe. But I doubt that we'll get anything coherent out of him while he's in this condition."

Suki shook her head. "I wouldn't have thought it possible he'd get to this state. I bet it's the first time he's had anything more alcoholic than a fruitcake."

"Not to mention Vladdy's secret psychedelic." Jacques let out a long sigh. "Better let him sleep it off here. We can talk with him in the morning."

"What if he wakes in the night and decides to go home?"

"I don't think we should let him," said Jacques.

"Do you mean, hold him captive?"

"Legally, in fact, we're obligated not to let him drive home in his condition." Jacques smiled. "As is the case with well-fitting briefs, the law will support us."

"Legal briefs?" said Suki, smiling. "But I take your point. And I shall take the first watch."

Kendrik became gradually aware of his face being licked. He opened his eyes and then clamped them shut; the frenetic motion of Oxy licking his face and the shafts of morning sunlight jabbing into the room were more than he could stand. He inhaled sharply, got a lungful of dog breath, and waited until the searing splinters of color went dark. He pushed Oxy back and then gingerly eased open his eyes.

Tentatively and in slow motion, he got to his feet. He found a bathroom and then, hearing sounds of human activity, he walked down a short corridor, found a door slightly ajar, knocked, and came into a kitchen.

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"Ah, the sleeper wakes." Jacques, measuring coffee into a pot, looked at him with a worried smile. "We've been waiting for you."

Vladimir, sitting with Suki at a small, utilitarian table, beckoned Kendrik to join them.

"So, my friend," said Vladimir without preamble as Kendrik pulled up a chair, "who sent you here to Canvas Cooperative?"

"What? I told you." Kendrik rubbed a hand across his forehead. "At least, I think I told you. Gosh, what a party." He shook his head to clear it. "Nobody sent me."

Vladimir pounded a fist. "I think government sent you."

"Don't worry about Vlad," said Jacques. "For historical reasons, he doesn't have good feelings about government." He turned up the flame under the coffeepot and ambled over. "Sounds sort of like a good coop-bad coop routine, doesn't it?"

Kendrik thought hard, trying through his haze to remember if he'd made some awful gaffe the previous night. "What's going on?" he asked. "What are you all upset about?"

"Why did you come to the party?" said Jacques in a pleasant, conversational tone.

"I was looking for a group of people with synesthesia."

Jacques and Suki exchanged quick glances, while Vladimir glared at him.

"What?" said Kendrik. "I didn't think it was a secret or anything."

"It really isn't," said Jacques, "but we don't exactly shout it from the minarets."

"As for being upset," said Suki, "you did give us some very disquieting news last night."

"Oh?" Kendrik found he couldn't remember very much from the night before.

"The news," said Jacques, "that the Bureau of Disease Control has determined that synesthesia is an infectious disease."

"No." Kendrik waved him quiet. "It's only my idea. My boss thinks I'm nuts."

"I not believe you," said Vladimir.

"It's not clear." Suki glanced at Vladimir. "His deportment last night did not suggest an official visit."

"In any case," said Jacques, gazing at Kendrik with narrowed eyes, "I am curious why *you* believe synesthesia's a disease." He gave a wan smile, clearly forced. "I rather like to think only our enthusiasm is infectious."

"And *I* wonder," said Kendrik, after glancing from face to face, "why are all of you so anxious about this disease idea?"

Jacques slid a teaspoon to the center of the table. "As long as they think we're just wacky artists, they'll leave us alone." He tapped the spoon. "But if they realized we were truly different . . ." He drew a circle around the spoon with a forefinger. "If they called synesthesia a disease, they could quarantine us—keep us under observation."

"No," Kendrik protested. "Why would anyone do that?"

"People with no imagination," said Jacques, "often are afraid of those who have lots of it."

Vladimir swiveled the spoon and pushed it toward Kendrik. "But you not explain," he said, "*why* you look for people with synesthesia."

Kendrik shrugged. "Just research."

Suki gazed thoughtfully at Kendrik. "There is more, isn't there?" she said in a cadenced voice. "Not without cause does an office-dweller break through his window and become a bird of paradise, radiant against the Sun . . . so to speak."

Jacques and Vladimir exchanged looks of shared suffering.

Kendrik drummed his fingers on the table. "More like a turkey or a dodo," he said. "I'm a flightless bird."

Suki covered his hand with hers, calming the drumming. "No. You must not think that." She withdrew her hand. "You must kill that turkey. Kill the dodo.

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Then you can soar."

"The point is . . ." Kendrik toyed with the teaspoon, "I've found a correlation between synesthesia and imagination." He looked down at the table. "I think it's causal. Synesthesia yields imagination."

"And?" said Suki.

"All right," said Kendrik. "If you must know, I want to contract this synesthesia disease. There! Now you can laugh."

"To become infected with imagination?" Suki laughed. "That's ridiculous. Anyone can see you have a rich imagination. You've been brainwashed and it's damaged you."

"I guess nobody bothered to read the care instructions before brainwashing."

"I'm serious," said Suki.

"So am I," said Kendrik. "I don't have a creative imagination."

"Why do you say that?"

"Because of how I did on the skeekit-woogle test."

Jacques looked up. "The what?"

Kendrik described the test, and concluded with, "So which word means a shard of glass, and which word means an egg?"

"Is it shelled?" said Jacques.

"The egg? Yeah."

"All right," said Jacques. "Woogle is the egg and skeekit is the glass."

"That's what pretty much everyone says."

"But not you?" Jacques gave Kendrik a quizzical look.

"No."

"Odd," said Suki. "How do you see it?"

"Well." Kendrik put his elbows on the table and rested his head against his hands, his palms covering his eyes. "If I think in black and white, with smell off, I get Jacques's answers. But imagining normally . . ." He spread his fingers and looked out at Suki. "Woogle has a flowing, liquid feel—like water. And glass has the color of water. Also, neither water nor glass smells—so woogle means glass."

"And skeekit?" said Jacques.

"Skeekit is bright, brilliant like the disk of the Sun, and sharply pungent. It's like the sulfurous smell of a brilliant white egg on a tickly-smelling fresh-cut lawn under bright sunlight. Skeekit is round, bright, and smelly. It's the egg."

Jacques, Vladimir, and Suki exchanged wide-eyed stares. "Imaginative, yes?" said Jacques.

Kendrik, seizing the momentary pause, leaned back, and took a deep breath. "Ah," he said, his nose raised and pointed toward the coffeepot, "the sweet brown aroma of freshly brewed coffee—dark amber with flecks of silver in a herringbone pattern."

Again, the three exchanged glances.

Jacques leaned in over the table and stared intently at Kendrik. "So you came here to catch a case of imagination."

Kendrik couldn't help smiling; it sounded so silly. He let out a breath. "Yes," he said. "A creative imagination. I want it so much that I can taste it."

"And smell it?" said Jacques.

"What?"

"You smell in color and shapes, don't you?"

"Of course," said Kendrik. "Everyone does that."

"No, they don't," said Vladimir.

"I knew it!" Jacques slapped the table. "For Vlad here," he said, "it's all color—cool colors, loud colors. Literally. He hears and feels colors, but he doesn't smell them. And Suki tastes words." He glanced over at Suki. "You don't smell them, do you?"

She shook her head.

Jacques chuckled. "Welcome to the club, Kendrik," he said. "You've probably had synesthesia your entire life—not that you've lived very much of it yet. Odd you never noticed it."

Kendrik scrunched up his nose. "Really?"

"*Da*, my friend," said Vladimir. "I was wrong. You not from government." He gave Kendrik a bear-like pat on the back. "You appreciate 'Great Gate at Kiev.' You have taste."

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"Thank you," Kendrik gasped. He struggled to recover from the pat.

Jacques looked away at the coffeepot, which was now bubbling. "Coffee's ready." He stood and walked to the stove. "We believe, by the way, that synesthesia might well be the next stage in human evolution."

"What?" Kendrik struggled to keep up.

"I'm not sure we should be talking about this," said Suki.

"Why not?" said Jacques. "He's in our camp, now." He turned to Kendrik. "You *are* in our camp, aren't you?"

"So *that's* what this has all been about," said Kendrik, more to himself than to Jacques. He nodded. "Yes, I think I am in your camp."

"Splendid," said Suki. "Now though, we'll have to find a creative outlet for you—to keep you putatively sane."

"He's a technical type," said Jacques. "How about flavor chemistry?"

Kendrik chuckled, softly so as not to aggravate what he assumed was a hangover. "Perhaps I could paint scent canvases."

"*Da. Khorosho*!" said Vladimir. "Very good! I like idea. Maybe we collaborate."

"I'd enjoy that." Kendrik rubbed his chin in thought. "It does seem strange though," he said, "that a bacterium or virus could guide changes in our evolution."

"It not germ," said Vladimir. "It gift!"

"Doubtless," said Jacques. "And I don't wish to be the dentist of the horse bearing it." He brought the pot to the table. "But I suppose a bug might possibly be the agent of evolution." Pouring the coffee into the waiting mugs, he added, "Interesting thought—a bacterium aiding in brain rewiring. A bug turning us into a new species." He sat, picked up a mug, and cradled it in his hands. "An advance not in intelligence, but in creativity."

"Good thing," said Vladimir. "Mankind probably intelligent enough."

"Maybe," said Jacques. "Maybe the combination is required for wisdom." He smiled at Suki. "You always say that imagination is the food for our dreams—but then again, you taste words."

"Speaking of food . . ." Suki turned to Kendrik. "Will you join us for breakfast? Fresh scones and marmalade."

"Thank you, but no. I need to go home and maybe be sick."

"I understand."

"But," said Jacques, "I'm not sure you should be driving quite yet."

Kendrik laughed. "My car has automatic. With my sense of direction, I need it. And I have an assigned spot, so the car can autopark." He gulped down his coffee and stood. "I'll be back though, if I may."

"Any time." Jacques nodded. "I rather assume you feel like an outsider most places. I can assure you, you won't be an outsider here."

"Thank you."

Jacques accompanied Kendrik to the door. "We'll wait until your next visit to sign you up—when your hands are more steady. You do want to join, I imagine."

"Definitely—now that I know that *I* imagine as well."

"Good," said Jacques. "We'd appreciate it, by the way, if you didn't advertise the goings-on here."

"Understood."

Kendrik bid his farewells and went to his car. He got in, engaged automatic, reclined the seat, and threw his head back against the neck rest.

"Are you all right?" said the car.

"I've been better." Inwardly, Kendrik winced. *What an inane thing to say—even if only to a car.*

"My air sensor suggests a hangover."

"Do you think dogs smell in color?" said Kendrik, idly. "Can animals have synesthesia?"

"I do not have data on that," said the car.

Unaccountably irked by the car's answer, Kendrik glared at the speaker grill. "I've never noticed this before," he said,

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"but your voice sounds rather the way the smell of green should feel."

"The cabin alcohol level and your behavior suggest that I take you to a hospital."

Kendrik moved his seat back to upright. "No. Just give me a few minutes." He flipped the control back to manual.

Sitting there, collecting his thoughts, Kendrik mused on how everything in his life had seemed so ordinary and dull; and now, voluntarily, he was going back to it—the life of a turkey and a dodo. He realized it now; he'd been imagination-starved. And, come to think of it, he felt starved in the conventional sense as well. Kendrik got out of the car and, thinking he might kill two birds with one scone, headed back to the coop for breakfast. Jacques was right; he didn't feel like an outsider at the coop. And it would be fun spending time exchanging ideas with the man. Jacques was very imaginative and very bright . . . very skeekit. ■

IN TIMES TO COME

Boundary Condition, Wil McCarthy's lead novella for April, takes us to a weather station unlike any you've ever encountered. It's in orbit, which it makes it susceptible to some very dramatic action, but that's the least of its unusual features. Its methods involve practical applications of some far-out applications of quantum mechanics—which bring it into unique juxtaposition, both literally and figuratively, with some of the oldest ideas and institutions of humanity. All of which makes for an intense, thought-provoking, and haunting story.

Stephen Baxter offers the latest of his popular "Tales of Old Earth," and, on the "Science Behind the Story" section of our website (www.analogsf.com), a fascinating look at the background of this exceptionally exotic world. Jack McDevitt has an unusual collaboration with astrophysicist Michael Shara (whose name you may recognize from *Scientific American* or elsewhere), and we'll also have a highly diverse selection of stories by such writers as John G. Hemry, Richard A. Lovett, and Stephen L. Burns.

Alexis Glynn Latner's fact article, "The Shape of Wings to Come," springs from an unusual perspective: as a sailplane pilot herself, she's done a lot of thinking about the past, present, and future of gliders. Because of their deceptive simplicity, you may think of them as "low technology"; but if so, you'll probably be surprised at how much thought has gone into their design and construction, what they have already accomplished, and what they might achieve in the future—both on Earth and elsewhere.

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Wildlife

Henry Melton

Everything changes—
including, necessarily, definitions.

Greg Hammersmith frowned at the frozen image of a blue-winged teal tugging at the grass with its beak. *The keystone is off.* The deck-of-cards projector tracked his finger and corrected the frame.

"Off." The bird vanished, long enough for him to spray a fresh layer of canvas on the wall where the image had been. "Calibrate and burn. Ten percent impressionist. Two-inch frame, cinnamon."

After the projector did its thing, Greg picked the gadget up and stuffed it in his shirt pocket.

That gives the room some life!

But his smile faded. *I've already used up one bottle of Canvas already.*

In his pocket was every picture he had taken in his thirty years as a nature photographer back on Earth. There were many good shots, one blank space on the wall, and a nagging need to fill it.

One thing for sure, there would be no landscapes. Not with the scenery outside.

Greg's one-man habitat was sitting two kilometers to the west of Byrgius Crater, site number three in his year-long photo shoot. It had taken eight years to get the funding and approval for his unique photo-essay on the lunar landscape. Twelve sites, one for each month, taking out time to relocate the habitat in the middle of each long lunar night.

The perfectionist in him wished he could set up his cameras and have a complete synodic period of twenty-nine and a half days to get every possibility of light and shadow on the craters and rills he had chosen, but some trade-off had to be made to keep the International Photo-Artistry Guild happy and a one-year job with an even dozen sites was the limit of what they could fund. As it was, his first site, with no Earth in the sky, had been terminally boring once the Sun had set. At least on the earthward side, subtle changes in color reflected from the Earth's blue and white

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gave some variety to his shots.

He looked the bird in the eye. Greg remembered that teal. The duck had waddled ashore looking for crumbs left over from the tourists, alert for a handout, but still wild enough to keep his distance.

I miss wildlife. Luna is grand, but it's sterile.

Eighty percent of his photo library was animal shots—his official biographer had coaxed that admission out of him. He had only gotten into photography to capture the critters.

There are none here. He hadn't realized how much he missed animals until the tug relocated his habitat from Riccioli a couple of weeks ago, bringing fresh supplies, and two dozen fruit flies along with the produce.

The infinitesimal insects died quickly, in spite of his precautions. In all his years, he hadn't really appreciated how short their lifespan was. Usually they reproduced so fast that they just appeared immortal.

These had survived Lift-Luna's food sterilization somehow, but not totally undamaged. His close-up macro photos of his guests had shown evidence of deformed wings and if he had been an entomologist, probably other mutations. Fascinating photos—but they weren't the kind that would sell.

Deedee dum, dedum. "Time for the photo of the day."

Greg nodded to the computer. "Okay. Give me a minute." He brought up the album and scanned through the last twenty-four hours' worth of images.

At each new site it took a couple of days to get the cameras positioned. About half of those he did himself, trudging around the landscape in a vacuum suit, riding a golf cart. The others he put on tripods and sent them to position themselves. From then until the end of the month, he stayed indoors and rode herd on his remote eyes from the comfort of his desk.

At this sun angle, only three of the cameras were producing anything approaching artistic landscapes. Gigapixel frames were captured from each of the cameras every ten seconds. Of course he saved it all for later re-evaluation, but for now he scanned the day's worth as a high-speed movie, looking for some transient reflection or coloration that would make for an interesting . . . .

"Ah, there it is."

He backed up the movie and located the best frame.

Three peaks on the nearby ridge had roughly the same surface angle and the Sun outlined similar crests. "Three Kings" he typed in for the title. Cropping the image to center the peaks and tweaking the color balance for best effect, he let it sit on the side screen while he hunted for better candidates. After thirty minutes of searching and three other potential winners, "Three Kings" was still the best. So off to the L-4 relay station and then to Earth—in under ten seconds the day's tribute to IPAG was in place.

Deedee dum, dedum. "Review the Brazilian shoot proposal."

He frowned at the images from his easternmost camera. "Reschedule," he told the computer. It would nag him about it later.

The next shoot in Antarctica was already contracted. Perhaps that had been a mistake—two barren environments back to back—but it was only for two months. Was the boat trip up to the headwaters of the Amazon an over-reaction?

Still, the only way to survive in this business was to think ahead, find out what people want, and be the first to give it to them.

It would be nice to be in a jungle shoot again, with wildlife appearing around every bend of the river.

But he could think about that later. Right now, there was a defect in camera 8 that he had to resolve.

In the lower left of the frame, where

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the gray plains were just beginning to show shading as the Sun crept across their rising elevation, there was a thin black line, straight as an arrow, where there had been nothing more than the random texture of microcratering.

Did I put it there? He had positioned the cameras during the lunar night, taking great care that none of the other cameras and none of his golf cart tracks would be visible from any of the sites. But taking precautions never stopped him from making blunders before. Camera 8 was due to supply some great sunset shots in another week, and if he had ruined the frame, then he would have to take action quickly.

Or it could be a defect in the camera or the lens.

He looked at the site map photo he had taken.

"Camera 8, reposition yourself three meters to the south, facing the same direction."

A "Motion Jitter" warning appeared on the screen as the tripod took a few steps to the south. When it cleared, he captured the first frame. Visually it looked identical.

"Match and overlay. Zoom to pixels."

The frames were nearly identical, except at the edges where the errors caused by the re-pointing were visible.

So, it's not a camera defect. That line exists out there on the landscape.

"Position back one day on camera 8, match and overlay."

The black line flickered on the screen.

So I didn't miss it. It appeared sometime today.

"Scan forward in time at 20x." He would locate when it appeared. Maybe as it faded into view, he could see more irregularities. Straight lines weren't unknown in nature, but true ones were rare. Catch a horizon or the trunk of a tall pine in the right light and nature will show all her wrinkles. Greg's career had been built on nature's wrinkles.

He expected irregular dots to appear and then connect into a line. That's not what he got.

"Stop! Back that up and replay it."

As the line grew longer leading from the edge of the frame, he felt his remaining hair stand on edge. He wasn't alone. Someone was out there.

"This is Greg Hammersmith. Stop right where you are! You're messing up an important photo. Answer me."

Short-range radio was line-of-sight only—it had to be with no atmosphere—but the idiot was in the line of sight. That was the problem!

With no answer, and with the line growing across the scene hour by hour, Greg kept looking over at the airlock.

Camera 8's frame is ruined already. If I don't take action soon, he may take out camera 10 as well.

He kept one eye on the map as he drove the golf cart across the rough landscape. The computer had sketched areas on the map that were hidden from all of the other cameras. It was zigzag at best, and seemed designed to cross the worst boulder fields in the area.

Greg was grinning, or maybe just clenching his teeth. It was good to get out of the house, but his schedule was wrecked for days. He rehearsed his greeting.

Do you have any idea what you've done? Taking nature photographs isn't anything like it was when I was young. Back then I'd think nothing of dropping an image into Photoshop and erasing an offending line, but photo ethics has changed. IPAG and all its brothers would blacklist anyone who faked any details in a nature photo. Even color balance has to be spelled out in detail.

These lunar landscapes are unique. Day by day more footprints are scarring up the dust—footprints that never fade.

Your tracks are destroying the only true record humanity will ever have of

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the primeval lunar landscape!

Greg caught himself weaving back and forth across his "safe zone." He grinned. *Not likely I'll be able to sustain the righteous indignation while leaving my own tracks across the dust.*

It was true he had to stop his unwanted guest. It was also true he was looking forward to meeting anyone with warm breath and a pulse.

The hunt was exciting too. *It's like the time Lisa spotted the grizzly from Mt. Washburn, and we raced down the old dirt road to be in place when the bear crossed near the highway.* He had gotten excellent photos of it by being in exactly the right place and the right time, but that was long before he had gone professional.

There had been so many good hunts, living on the road, or living in the field—on assignment, or to complete a book. And after her death, as painful as it was to live alone, the hunt for a reportedly-extinct finch across five states had been the only thing that kept him going.

Wildlife keeps me alive.

Every fresh encounter was a thrill, every cautious approach a refresher in humility, and every crisp image a triumph. Eye to eye with a non-human intelligence put a face on the universe for him.

Luna was a stretch. Yes, his "Canadian Rockies" had made his reputation, and his "Great Mountains of the World" book series gave him the freedom to travel anywhere. But for him, the centerpiece of the mountain pictures had been the cover of the Rockies book, a morning-light image with a bull elk atop a sheer cliff, surveying his world. The theme was repeated throughout the photos—great animals living in great surroundings. Often the animal was almost imperceptibly small, and only he or a perceptive critic could see it, but the stamp of life put soul in the scenery for him.

But there was no life in these lands. It was a mistake for an artist to forget his own passions. Mastery of the craft can only take you so far.

Greg shook off the feeling that he was stuck in a doomed, high profile project. He could master the lighting and capture the sterile splinters of these peaks, but without life, there was no soul.

Deedee dum, dedum. The chime sounded in his helmet. "Approaching your destination."

The cart crested the rise and there was the track. Camera in hand, he stopped and snapped several shots. *It's not a wheeled vehicle.*

He stepped closer. There was a single continuous track in the lunar dust. *It's not footsteps either.*

Greg had expected a man, in a vehicle, or possibly on foot. This was neither.

The shutter click was inaudible and it bothered him. Even when cameras no longer had any moving parts that made noise, he always turned on the shutter sound. Without the feedback it threw him off.

He zoomed in for a closer shot of the tread marks. *Either a huge unicycle, or the grandfather of all pythons came through here.* The ridges across the direction of the track looked familiar.

Braced with the camera body against his helmet, he could hear the shutter faintly.

And the memory clicked.

Those are tripod tracks!

Everyone called them tripods, although they came with five to eight legs depending on how much weight they had to carry. The mobile robots with long legs were perfect for the dusty lunar surface. They had no moving parts, at least in the old "gears and bearings" sense. Legs moved by electrostriction. Dust could cling, at least until the tripod reversed its static charge, but there were no hinges or grooves where grit could be trapped.

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Greg had used the robotic tripods on Earth several times, once he had the budget to afford them. On Luna, they were essential.

He put the golf cart in high gear and went bouncing across the landscape following the long patterns in the dust.

It can't be one of mine. All of my cameras are exactly where I left them.

A flicker of motion in the distance made him put on the brakes. His zoom lens brought his quarry into focus.

It was grayer than his tripods, shorter and wider. Instead of a camera, a fat instrument cluster rode on its "head." The gadget was plowing away in that spinning-top gait the tripods used for easy terrain. The whole device spun around and around, laying the legs down in sequence, leaving a track like a giant snake.

Greg snapped a long sequence. *I'll have to use the golf cart. It's moving too fast for me to catch it on foot.*

As he drove over a rise, he scanned for escape routes a startled prey might take. *If it ducks into that boulder field, it could lose me.* He angled the cart towards the rocks. If it bolted, he wanted to force it towards open ground.

The thumbwheel on the camera let him set the shutter speed higher. Shooting with one hand while driving demanded it.

He came up even with the whirling tripod. *It looks like a fat gray octopus.* The device appeared to ignore him. It didn't bolt, but it didn't slow down either.

A familiar company logo was painted on it's side, Mascon Mining.

But up close, he could see that it was damaged. The stub of an antenna caught the Sun's reflection every rotation. There were other scrapes, but he couldn't see more while it was moving.

Get ahead of it. He darted ahead a few meters and pulled the golf cart broadside across the tripod's path. His prey curved to one side. He edged the cart forward and blocked it again.

The tripod dropped out of spin mode and began crab-walking to one side. Greg hopped out and stabbed at the halt button on the top.

The tripod leveled itself and stood there, waiting.

Deedee dum, dedum. "Incoming call from Orin Lewis."

Greg leaned back from his desk and smiled at his publisher. "Hello, Orin. How have you been doing?"

There was the usual delay for the distance.

"Greetings there, Greg. I just wanted to check in with you. Only a couple of days left before you leave Byrgius and I wanted to confirm your change of sites personally. We spent so much time choosing the original set, it surprised me to see you putting Tycho back on the list. You had been so adamant about staying far away from human settlement. Why the change?"

Greg smiled. "You know how it is, Orin. Once you get in the field, all your carefully laid plans go out the window. I could tell something was wrong at Riccioli but here it came into focus. I'm here to shoot the Moon as it is, not to make some statement about human footprints."

Orin nodded as he listened, and then commented, "I could see that something had changed a week or so ago. I forget when, sometime after that 'Three Kings' shot, your stuff started getting more lively, more like your Canada work."

"Yes. I saw a piece of mining equipment, and I realized that life was coming to Luna, even if it is just men and men's surrogates for now. With life, the whole landscape came alive."

It had taken him hours to get the rogue tripod loaded onto the golf cart and packed back to his habitat. Repairing its antenna and visual sensors was a job beyond his technical capabilities, but he was a photographer—he knew his way around computers.

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Digging into its files he found that for over three years, the semi-autonomous device had struggled to follow its fall-back programming: *If out of contact, return to base.*

The problem had been that the rock fall that took out its radio also blinded it. With no radio or star fix to guide by, it had lapsed into a pattern of following the Sun, which it could sense from its charging cells. The prospector-robot slept at night and traveled by day, only able to detect obstacles in its path with a flea-power radar and its neutron-emission detector. Cut off from its original duties, it had gone wild—Lunar wildlife.

Orin accepted Greg's vague explanation. "You're the artist. If the rest of your stuff is up to last week's standard, we should have a best seller when you get back.

"Judith and I would like you to come out to the cabin with us, once you get out of low-g rehab. There's a great trout stream, just your style—I know you're a 'catch-and-release' kind of guy."

Greg grinned widely. Orin had a knack for knowing what he would do. "Catch and release" was just the kind of guy he was. When he had reactivated the old tripod, turning it loose to find its own way across the enormous lunar surface, it had been as natural as breathing.

"It sounds great, Orin. Although I don't look forward to rehab.

"By the way, could you put in an order for three more tripods in the next supply run? There was a programming glitch and a couple seem to have wandered off." ■

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THE UNIVERSE OF CHOICE

Our universe supports life because of some rather remarkable coincidences. If the values of the physical constants that govern the fundamental forces and interactions in our universe were just a bit different, then life (or at least, life as we know it) would be impossible. I devoted a previous column ("The 'Real World' and The Standard Model", *Analog*, May 1996) to a discussion of some of the consequences of tinkering with some of the physical constants, but let me give some further examples here.

If gravity were a bit stronger, the universe would have long since collapsed to a black hole. If gravity were a bit weaker, galaxies would never have formed. If either the strong or electromagnetic forces were a bit different in strength, the neutron would be less massive than the proton, and the universe would be filled with neutrons and neutron stars, with few atoms or nuclei. If the 7.654-MeV energy level in carbon-12 was not precisely where it is, the nuclei of carbon and the heavier elements could not have formed from helium in burned-out stars and supernovas, and there would be no heavy elements to make planets and people. And so on . . .

The most recent realization that our universe is "special" comes from the observation (see "Our Runaway Universe and Einstein's Cosmological Constant", *Analog*, May 1999) that the rate of expansion of the universe is itself accelerating. This implies that Einstein's cosmological constant is not zero: in other words, that there is a small but non-zero density of "dark" energy in the vacuum itself, which creates a negative pressure driving the accelerating expansion. Cosmologists are coming to realize that the remarkably small but non-zero size of this vacuum energy is another "accident" that makes life in our universe possible.

It's fair to ask (while difficult to answer) the question of whether the values of the fundamental constants, including the cosmological constant, are just lucky accidents, or whether there is some mechanism that arranged them to make life in the universe possible. One way providing an answer to this question is through the Anthropic Principle. The Anthropic Principle asserts that since we, as living beings, are present to measure the fundamental constants and ask where they come from, they must be arranged to make living beings possible. Otherwise, there would be nobody around to ask the question. This *is* an answer of sorts, but it is not a very satisfying one.

This situation in cosmology is a bit like the theology of the middle ages, which insisted that the Earth was the center of the universe because God made it that way. Galileo got in a lot of trouble for discovering the moons of Jupiter, a planetary system in miniature visible with his newly invented telescope, and suggesting that by analogy the Earth might be just a satellite orbiting the Sun, as Copernicus had previously claimed, rather than the center of

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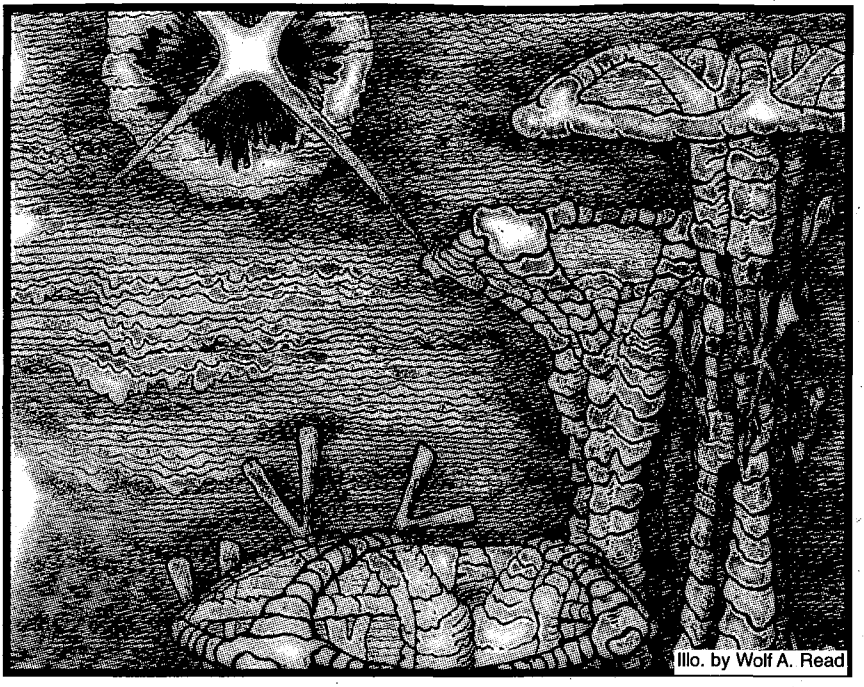
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the universe.

As long as there was only one Planet Earth and we were living on it, it appeared that divine intervention was required to make things come out the way they are. However, we now know that there are a huge number of galaxies in our universe, a huge number of stars in each galaxy, and that most of those star probably have planets orbiting them. From such a cosmic perspective, the Earth is a much less special place, perhaps just one of a very large number of planets in the universe that can support life, perhaps including intelligent life. Earth has been demoted from the center of the universe to the sidelines.

Prof. Leonard Susskind of Stanford University has recently proposed a view that resembles this cosmic perspective, but as applied to *universes* rather than planets. This perspective comes from string theory, an area of theoretical physics that has for the past decade been the intellectual focus of major theoretical activity in the physics community. String theorists have been exploring a mathematics that describes fundamental particles (quarks, leptons . . .) as vibrational standing waves on hyperdimensional strings. The string theory variants that describe such a worldview, as they have developed, were found to be divisible into five different string theory classes. Later, new insights regrouped them into "M-theory," within which the five separate string theories were special cases, special solutions of a master theory. However, there is one problem in comparing our universe with all of those "universes" described by string theory variants. All of the string-theory universes have a zero cosmological constant. The problem is that the master theory is too symmetric—there is a boson for every fermion—and this symmetry sets the cosmological constant to zero.

Susskind deals with this problem by

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asserting that there must be "islands" of reduced symmetry lying "off the coast" of the super-symmetric main body of string theory. And he further asserts that the number of such islands must be extremely large, numbering far more than the number of electrons in our universe.

What distinguishes these islands (which can be thought of as universes) from one another is the value of the cosmological constant (which has an indirect effect on some of the other fundamental constants) within them. Susskind calls the ensemble of such string theory universes "the landscape of string theory." This landscape is populated by a vast number of universes, each with a different "ground state vacuum," in other words, with a different cosmological constant and amount of dark energy in a given volume of vacuum.

The observed value of the cosmological constant constitutes a difficult puzzle. The difficulty for both orthodox quantum chromodynamics (QCD) and the more speculative string theory with the density of vacuum energy in our universe is that it is very small, but not zero. These theories were well prepared to explain either a zero vacuum energy (e.g., with supersymmetry) or a very large vacuum energy (e.g., with standard QCD). However, a small-but-not-zero vacuum energy density is far more difficult, because it requires "fine tuning" to get the vacuum energy "just right" to make a universe like ours. This is sometimes called "the Goldilocks Problem." Up to now, cosmological theorists have been unable to suggest a mechanism that could solve the Goldilocks Problem. Susskind is attempting to supply such a mechanism by invoking the Anthropic Principle, as applied to universes.

Basically, he argues that of all the universes populating the string-theory landscape, at least one must have a ground state vacuum that has a "just-right" amount of dark energy in the vacuum—small, but not zero. In that universe, life would be possible. The vast majority of other universes would be lifeless. Therefore, since we exist as living beings, we must reside in that just-right universe. In other words, the dark energy in the vacuum is small, not because some fine tuning set it that way, but because our universe in one of the few populating the string theory landscape in which in which it is low enough to make life possible.

In the Susskind scenario, the Big Bang created a vast quantity of "bubble" universes. The vacuum of each of these universes was initially filled with dark energy, driving the superluminal expansion we call inflation. At the end of the inflation period, the vacuum energy density dropped until it reached a bottom level, a vacuum energy ground state. And because of the vast number of islands in the landscape of string theory, there was enormous variation from universe to universe in the value of the ground state energy. Thus, if our universe has low ground state energy, it should be no surprise, because *some* universe should have such a situation.

Susskind's scenario tells us, therefore, that most of these universes will be lifeless and inhospitable to visitors, perhaps empty of stars, perhaps empty of matter, perhaps the site of a black hole collapse or a Big Rip super expansion.

What are the science fiction applications of Susskind's ideas? Obviously, the idea of a multitude of universes, parallel or otherwise, has been written about many times. Steven Baxter, in his novel *Raft*, hypothesized a universe in which the gravitational force was much stronger than in our universe and in which castaway humans struggled for survival in an alien and hostile universe, into which they have somehow been deposited.

My own novel *Einstein's Bridge* is built on the assumption that there is a multiplicity of separated "bubble universes," and that wormholes (in the

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physics literature, originally called "Einstein-Rosen Bridges") could be use to communicate and travel from one such universe to another.

In Susskind's scenario, universes containing life as we know it would be few and far between. The average universe would have a large vacuum energy, which would cause it to have accelerated expansion to a state where it was essentially empty. Universe hopping would be a lonely business, with a very low probability of finding anything interesting. Explorers would need some advance signal of the presence of intelligent life (see, for example, *Einstein's Bridge*) to make it worth expending the resources to make contact with another universe.

Is Susskind's scenario viable? Time will tell. It requires some advances in string theory to verify his speculation of "islands" with varying cosmological constants. From another perspective, it may have a problem with Occam's Razor, since it justifies the state of our present observable universe by hypothesizing that it must have a very large number of unobservable siblings. It therefore suffers from the same malady as the rest of string theory, in that untestable hypotheses, particularly those making spectacular claims, are not subject to testing and improvement through the use of the scientific method.

But in any case, it's an interesting idea that may be worth consideration by writers of science fiction.

AV Columns Online: Electronic reprints of over 120 "The Alternate View" columns by John G. Cramer, previously published in *Analog*, are available online at: http://www.npl.washington.edu/av. The preprints referenced below can be obtained at: http://www.arxiv.org.

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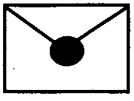

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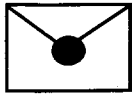

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Larry Niven

PLAYHOUSE

And you thought babysitting
for *one* species was hard?

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Illustration by John Allemand

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Day Zero

Long View reached lunar orbit as so many Chirpsithra-manned passenger ships had done before, but faster, skipping steps. There was a curtness to their negotiations with United Nations traffic control. The lander turned loose from the big ship before its orbit about the Moon was well established.

I was spending a few weeks with Jehanneh and Walt in Saddam Hussein's palace in Tikrit. The army had turned some of his old palaces into hotels back in the Twenty Zeros. Amenities were primitive and the fad had wilted, so it wasn't that expensive, considering. Saddam had had lots of interesting playground equipment . . . for adults, of course, but Walt was having a good time too.

Then the liner hove into view near the Moon and I was called back. I left Walt and Jehanneh there. The Draco Tavern was no place for a two-and-a-half-year-old boy.

Day One

I got there ahead of my crew.

Reworking the Draco Tavern to accommodate new species takes a lot of preparation. I spent a few hours looking around the tavern, then called the ship to learn what kind of visitors to expect. I was waiting on the line, chatting with the translator device, when four Chirpsithra filed through the tall and narrow airlock.

Chirpsithra stand eleven feet tall. They're exoskeletal creatures, usually wearing tools and pouches and rank marks attached to their scarlet chitin shells. I've learned to recognize some of the marks. Three were ranking officers. The fourth wore a sigil I'd never seen before: a triangle with curved edges. They looked around, chattering to each other with their translators turned off.

I pointed at a sparker. *Want this?* The triangle-bearer spoke in Lottl, and I heard, "Rejected with thanks. Rick Schumann?"

"That's right."

"Proprietor of this?"

"Yes, the Draco Tavern. Welcome."

"Thank you. I am Queeblishiz, Matriarch of Lifesystem Support. We have a—" The translator hesitated. "—situation."

Running this world's only interspecies bar for nearly forty years, I've seen more "situations" than I could count. I said, "See if you can describe it."

"Our cold sleep facilities have failed."

"Oh boy," I said, before my mind quite caught up. How many extra visitors—? "Just a minute. Don't most of your passengers come down anyway? The Draco Tavern is popular. So's Earth."

"Passengers, yes," Queeblishiz said.

Still speculating, I said, "You'd have to fix what's broken before you can leave. You'll play hell finding tools for spacecraft on Earth." We'd abandoned the Moon more than forty years before the first interstellar liner showed up. "How long?"

"Perhaps forty days. We carry tools to make tools."

That didn't sound bad. But the other Chirp officers were still chattering at her, and she turned off her translator and chattered back. Then, "Barman, we must upgrade your facilities, particularly your defenses."

"Defenses?" Ohmygod. Sooner or later it had to happen. "What is *Long View*, a prison ship?"

"Close. Unlucky guess. *Long View* is not unusual, a typical passenger liner with cold sleep facilities for prey animals, pets, and children. These are breaking down. The ship is too small, massively too small. We'll go insane if we can't set some of our children free on Earth."

"And prey animals too? Do you plan to run hunts through my place?"

"Those we may slaughter and clone again later. We may require the owners to care for their pets, or slaughter them too. Our concerns are for the children.

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We have four varieties awake."

"That doesn't sound too bad," I said.

"Yes, but we must begin at once. We must childproof the Tavern."

I phoned Arlan and Genevieve and told them the situation.

Staff at the Draco Tavern are always volunteers; they're scientists come to interact with unearthly intelligences and alien disciplines. Children were not of interest. They both bowed out.

Children and pets are normally barred from the tavern. Variety in adult tool users has always caused problems enough.

The Chirps put electronic locks on the airlocks and toilets. I worried: what if a child was locked out? Queeblishiz reassured me. The children would have bar codes tattooed on their hides. Only the appropriate locks and toilets would open for them . . . and they wouldn't lock with a child inside.

Hah, that lesson must be universal! Walt hasn't locked us out of a bathroom yet, but it's a basic intelligence test for grown-ups.

The first child was already down. Djil was a streamlined humanoid massing around two hundred kilos. Most of a human's features were in place, but she had lids over everything: eyelids, earlids, no nose, no hair, a gristly filter behind the lips, and no obvious openings that a human would cover with clothing. I pictured her as coming from a windy, sandy world.

We put her in a shirt and jeans. She didn't object.

Djil explored the Draco Tavern and watched Queeblishiz impose childproofing changes. I watched it all carefully. Fragile stuff out of reach or locked away. Stairs blocked with a repel field keyed to the bar codes. Odd chemicals kept out of sight and touch, and that included everything behind and beneath my bar. Most of what I serve is lethal to something.

When a party of anthropologists showed up, Djil served their drinks, then got into an intense discussion of experimental methods.

"Her parents are too big to travel," Queeblishiz said. "They can arrest the development of children for a time. Djil is nearly seventy years old by your counting. She can babysit, but she must be watched."

"Why? She sounds like an adult to all intents and purposes."

"Watch her. Tend her. Djil's brain has not reached full weight, and she is as self-centered as any child."

Day Two

We barred humans from the tavern. Protests came from various directions. Sooner or later . . . but first we'd better see just how much of a problem the children were.

"There's no need to think of me as a child," Djil told me. "I'm older than you. My parents are excessively protective. They tried to stop me from leaving. We reached a compromise. I'm listed as a child, with fewer rights than a passenger."

"That's a pity," I said. "But why were you chosen to guard the younger children?"

"I'm an available sitter, and barred from roaming at will through *Long View*. The Chirpsithra are economical."

I'd still keep a watch on her. She was too big to be taken lightly.

Day Three

After two days of work, Matriarch Queeblishiz brought down the children.

The Rainbow Wyrms were snakes, six of them. They were caged when Queeblishiz brought them in on a heavy lift platform. When the field was switched off, they were gone too fast to be visible. For an hour they buzzed around the Tavern, bouncing off the lock fields whenever they got near the bar. They couldn't fly, but they could jump like coiled springs. They buzzed into corners and

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under booths, chasing down the mice.

A few minutes wore them out, and they slowed down. They were glittering orange and green, each half a man's weight, each about three meters long. You could see a fringe of little limbs growing down the ventral line. They slept a lot, usually wrapped in knots around each other. They were friendly to visitors; I could wear one wrapped around my shoulders and neck. They ate small mammals taken from another failing freezer. Visitors would have to be marked with bar codes; any rats and mice in the tavern were on their own.

Mit, Hel, and Sesch, the Red Demons, were a meter long, exoskeletal, with spiky red armor. "They'll attack anything their own size including each other," Queeblishiz said. "I'll give them police cuffs. They won't be able to come near each other. We can give them a confined space in the tavern."

I suggested, "Outside. You can fence out wolves."

The Chirp Matriarch accessed some beamed-in source of data. "Wolves? I think our three charges can handle such creatures. Bigger predators might be a problem. We'll confine them to a patch of tundra and watch them for as long as this warm weather lasts. We can put the Wayward Child outside too."

The Wayward Child was a filter feeder armed with gauzy wings and a tremendous vented cavern of a mouth. She needed a lift pack to fly; her world was less massive than Earth. Siberian summer wasn't exactly warm, but it was warm enough to generate immense clouds of mosquitoes. I was going to like having the Wayward Child around. As for the rest, we'd see.

Day Five

Another freezer failed.

We were lucky. It held Folk puppies. Folk from previous flights had traded for hunting grounds in various parts of the world. For a few dollars more, Nevada accepted seven hunters with their fifteen progeny. The Tavern never need see the feral pups.

"—and a few hundred Bebebebeque spawn," said Queeblishiz.

"A few *hundred?*"

Queeblishiz said, "Bebebebeque spawn must be culled. We will turn them loose in the tavern and leave the Rainbow Wyrms to deal with them."

I had long since stopped seeing signs of mice inside the Tavern, barring little heaps of tiny bones and tufts of fur. That was nice. I didn't want an infestation of bugs! "Why not outside? Give them more room to run."

"They like it warm," Queeblishiz said implacably.

Bebebebeque infants were the size of my thumb, little golden bugs looking a lot like their parents. For a couple of days they were all over the place, snatching food of the tee tee hatch nex ool variety, including my own meals. Hyperquick Rainbow Wyrms were all over the place, hunting them down. The bugs became scarce, then invisible. Survivors had learned to hide.

Day Nine

Jehanneh had worked in the tavern on and off for a year, before and a little after Walt's birth. It's a good way to study aliens. She knew the territory and she had all the passes. This time she didn't phone ahead; she just flew in.

I saw her coming through one of the bigger airlocks, dressed for Arctic cold, manipulating Walt and a lot of his gear. I went to meet her,

"Hi," she said. "If I'd phoned you'd have told me not to come."

I said, "Yes." I started moving Walt, his stroller, his toys, diapers, powder and Q-tips, food. "Where's your stuff?"

"Still in the SUV. But I got to thinking. Picture Walt in his teens, or in his thirties," her hands flat on my chest so I had to look her in the eye, "knowing that his father runs the only bar for aliens in the known universe—"

"But that's just Earth."

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"—and he never got in to see it when he was a kid." Her eyes roved, seeking the newest lot of aliens.

There weren't any, barring Speedy, who looks like an abstract sculpture of a turtle and doesn't move fast enough to notice. Speedy pushed his way through the jelly lock two years ago and is on his way to a booth. The Rainbow Wyrms were hiding, and the rest of the kids were outside, even Djil. Nonetheless Jehanneh said, "This place is the most wonderful toy on Earth."

"Yes, dear, but other children are using it."

"That's—"

A whirr and a wind and a glimpse of orange-green passed between our noses. Jehanneh yelped and threw herself back. I caught her wrists so that she missed falling on Walt and hit flat floor. I was kneeling beside her in an instant.

"I'm all right," she said, and sat up, and clutched the back of her head. "What was that?"

"That was the Rainbow Wyrms. They're very fast." They'd slowed down now, but six orange-green snakes surrounded us, ready to investigate. I snatched up Walt. "I have to put a bar code on him *right now*."

"Bar code?" She tried to follow me behind the bar. The field stopped her, so she watched while I peeled down Walt's shorts and stamped his butt. The mark was a simplified picture of a set of alien fangs.

"It keeps the others away from him." Keeps him from being eaten, I didn't say. "The tracers can read the mark through clothing. Show me some skin, woman."

She didn't argue: she bared enough of her butt for a flu shot. I stamped her.

"Rick, did you mean actual children?"

I started to explain. Djil had come in through the big lock, and I waved at her awesome pink bulk. "That's Djil. She's old enough to babysit. Djil, this is Jehanneh."

"The Red Demons are loose," Djil said.

"*Loose?* How loose?"

"Barman, I only turned my back for a time-hack. The sky was full of birds. The Wayward Child tried to catch one. You know, she shouldn't do that. These birds are much too big for her mouth, but there aren't any big birds where she comes from, and while I was turning around, the bird wriggled loose and dove down over the Red Demons and it hit the origin point of the field, the singularity." She waved her arms. "Flash! And the first thing the Demons did was try to get *me!* I got to the airlock—"

"Good. Don't go out there. Jehanneh, don't go outside."

Djil said, "The toilets are all around the back."

Not true. There was a bathroom for humans in my quarters, but all the alien sanitation equipment—"We'll find you a bucket. Are you all right?" The smell had just reached me: Djil was scorched across the back of her clothing.

"I am not hurt."

"I'd better call the ship."

One of the Red Demons was trying to batter its way to me through the tavern's glass wall. Though half my height, he looked spiky and devilish. I couldn't see the others. That bothered me.

The translator said, "Rick, hello."

"Get me Queeblishiz or any crewperson connected with children."

Matriarch Queeblishiz came on. "Barman, your call is opportune. Another freezer has failed. The lander is here boarding—"

"The Red Demons are loose. Your confinement field failed."

"Details."

I described the situation. One Red Demon was still watching me through glass. "I've lost track of two of them. Djil, what were you doing out there?"

"Feeding them, barman, but they didn't come. They wanted the birds. See, I dropped their food at the airlock."

Yes, I could see the cage and the red-

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furred prey inside. "Queeblishiz, they're hungry. They'll be outside chasing ducks. They'll still be wearing police cuffs if you can activate them. Can you track them?"

"If they're on the tundra, we can stun them from orbit, once the lander is in place. Keep them occupied." She clicked off.

Djil said, "Don't do anything to hurt the Red Demons."

"No." You didn't harm children, if that's what they were. Worse yet—but call them children. The one I could see was under an overhung roof. It stopped clawing at the glass, made a rude gesture, and went around the curve and out of sight.

The lander was near the Moon. We wouldn't get help from the Chirpsithra for many hours.

A bit of a search found the other Red Demons. All three were now wandering around the line of airlocks. One found a way to open the cage. They ate the prey animals, messily, then continued to explore the locks.

I hadn't been thinking in terms of escape until now. No problem: we could get out through the bar, downstairs and through the storerooms under the tavern. But it was safer in the tavern.

Then one of the Demons figured out the small airlock.

"Behind the bar," I ordered, and looked around and didn't see Walt.

"Djil," I snapped, "Get into the bar." I didn't want to worry about her too. Walt at two and a half was surprisingly agile. When he saw he was being chased he chugged off between and around booths, under float chairs, around the bar and off again.

Jehanneh and I tried to corner him.

It wasn't that easy. The Draco Tavern has been a dome for most of its life. There weren't any corners, and there were plenty of obstacles for adults. Another problem was that Djil hadn't obeyed: she too was trying to corner Walt.

I think Walt found her scary. She was too big. He tried to climb the ladder to the loft. The field repelled him, and he dashed around a booth and was lost to us.

One of the Red Demons had figured out the lock. He got inside; then looked around, undecided. The Rainbow Wyrms buzzed around us, bouncing off the fields. Walt charged at the Demon from around a booth, then stopped, startled. They looked at each other, then at Jehanneh and me easing toward them. Another Demon was coming through the small lock. Where was Djil?

Djil came up from the storage space under the bar. She was carrying four cages occupied by furry red creatures from another star. She opened the cages and shook the creatures out onto the floor.

The third Demon stopped just inside the lock, confronted by a lot of motion. He decided: he scrambled toward a sudden cluster of golden bugs. Something snapped, and he howled.

"They mustn't be hurt!" Djil cried. "Can't you see? They're the Chirpsithra males!"

Well, yes, I'd seen the resemblance. The Chirpsithra never talk about their sex lives, and nobody's ever seen one pregnant, and sexual dimorphism isn't uncommon even on Earth. *Sure* they could be carrying their mates in cold sleep.

The poor bastard was wriggling like he'd stepped into a bear trap. I couldn't see what had him; but it wasn't my doing. I guessed that the tiny Bebebebeque were setting traps. We'd better stay clear of them.

Walt cooed and tried to reach the Demon. The field held them apart. An airborne snake ricocheted off the Demon, then Walt, not attacking, just using the repulsive fields to play with momentum.

"Jehanneh," I said, "get behind the bar. Watch your footing."

"I have to get Walt."

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"Walt, follow your mother. Jehanneh, the fields won't let you pick him up out here. They don't work inside the bar. Walt!"

But Walt was playing with the snakes. When I tried to get to him, I stepped into something that snapped shut on my toe.

It didn't quite cut through my shoe. I wrestled my way out of it, noting the tiny components of a trap, noting also the Rainbow Wyrm wriggling out of another. Two Red Demons freed the third. I got behind Walt and shooed him toward the bar.

Day Ten

The lander came down eleven hours after I'd called for help. They hadn't found anything from the air, barring the Wayward Child, who had wandered several kilometers in search of bigger and better clouds of mosquitoes.

Queeblishiz came out surrounded by eleven Bebebebeque. They were normal size, the size of a fifth of Haig Pinch and somewhat the same shape. A massive yellow and purple snake followed them, a score of skinny arms folded along its belly. What followed the snake looked like a polar bear in a fur suit: the head was conspicuously large, with a shortened snout, and a pair of darker fur lapels ran down her snowy-white fur torso.

They made their ways through various airlocks.

The Red Demons, Walt, Jehanneh, and the five remaining Rainbow Wyrms were playing together, all separated by the fields. I saw Walt pounce on something small and furry, look it over, then toss it two-handed to one of the snakes.

The little snakes came at the big snake's whistle. I don't know what the Bebebebeque did, but a score of little bugs crawled out from somewhere and ran into the ring of big Bebebebeque.

So it was nearly over, and I wasn't sure how to feel about that.

***

I told Queeblishiz, "The kids can't get to each other, but that doesn't mean they can't play with each other. It's been like an invisible zoo. They like it. Walt dashed out there while we weren't looking. Djil turned the prey animals loose, and they've all been scampering around catching them, even Walt."

"I take it we still cannot invite visitors here."

"I'd say no. Look at the place, it's infested! But we're recording everything. We'll have videotape to sell. How are your repairs going?"

"We'll have a cold sleep locker in two days. Which of the children would you like to be rid of first?"

I thought. "It's getting colder. I wouldn't want to bring the Wayward Child inside. Better take her."

"Not these? Not the Red Demons?"

"We seem to have struck a balance. Just reassure me that the fields will hold."

"The fields will hold, and so will the police cuffs on the Demons. Also, you will have parents. We have persuaded them to tend their children until more tanks are available. My apology, Rick, that should have happened earlier. Our passengers are explorers; they may neglect their duties.

"Of course there are none to supervise Djil or the Wayward Child. Djil wants entertainment. We brought down a virtual set for her. The Wayward Child is harmless; let her roam free here. The Bebebebeque have finished their culling and will go back to the ship with their clan. I will stay to guard the Red Demons."

"One got injured."

"I see that. They heal fast."

"We lost a Wyrm too, to the traps. Who is the bulky individual?"

"Harharharish, come and meet the barman. Rick, she has been in cold sleep with her brood—"

Harharharish opened her lapels. Seven on each side, nestled in two vertical runnels, her brood clung to folds of skin

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and suckled. They looked like miniatures of their mother.

"She isn't sapient while she suckles, but that time is nearly over. Tomorrow the children will be all over the tavern and Harharharish will begin their education. Give me the bar code marker, Rick, before all chaos breaks loose."

Day Thirty-One

Her brood surrounded her in a ring. Harharharish was reading to them, in English. Walt was among them, listening quietly.

The Wayward Child was inside, hovering near the top of the dome. She wasn't happy. I couldn't help that. A blizzard was raging beyond the dome.

Queeblishiz spoke, and I jumped, because she wasn't in the tavern. "Rick, the lander is down. We will take the children aboard as soon as your climate is habitable again. How long will that be?"

"I never know how long a blizzard will last," I said.

Pause. "We'll send a tank."

Oh, yeah? "You carry a tank big enough for the Wayward Child?"

Pause. Hell, she must be in orbit around the Moon, not on the lander. "We'll generate it. One hour. Rick, this affair must have cut deep into your profits. We will pay recompense."

"That's fine."

One point four seconds passed. "I would have come to bid you goodbye, but I cannot tolerate your environment."

"Are you all right?"

"We're all pregnant."

The impulse to laugh disappeared in an instant. "What are Chirpsithra children like?

"Voracious," Queeblishiz said. "Goodbye."

Jehanneh handed me an Irish coffee, half strength. "I'm going to miss them," she said.

"Which?"

"Well . . . the mother bear. The rest I can do without, except that Walt loved the snakes. Djil, where do you go from here?"

Djil said, "Colorado. The Folk are planning a Grand Canyon run, puppies and all. They'll go home on the next ship. Where do you go?"

Jehanneh looked the question at me. I said, "From this point on, the tavern is for adults, unless it's adults and Walt. You've played barmaid here. You think Walt is safe?"

She thought it over. She said, "Yeah." ■

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Wasting Time

Grey Rollins

There are things we'd all like to be able to do, even if it required finding a loophole in the laws of nature. But you can't do just one thing. . . .

Christopher Arken quietly closed his office door behind Tammy. Although he would never say it out loud, it was clear that Ms. Odom wasn't going to do well in his introductory physics class. The semester was only six weeks old and she was already hopelessly lost. He had to give her credit, though, she was still trying. Most students in her position adopted a defeatist attitude and began skipping class rather than face the seemingly impossible task of catching up.

As he slid back into the chair behind his desk, he caught sight of the spider plant on the windowsill. It looked pretty bad. Sighing, he leaned towards the plant and probed the soil with his fingertip. Dry. He pushed himself to his feet, reaching for the plastic pitcher he kept on top of a filing cabinet. Not much water in it, but he went ahead and poured what remained onto the parched soil, watching it pool on the surface before soaking in.

Arken didn't really like the plant, but it was a gift from the departmental secretary, intended to cheer him up after the sudden death of his wife five months previously. Why women always wanted to give plants was a mystery to him. From his point of view, the damned thing was a burden to care for and a continual reminder of what he had lost. Still, he couldn't bring himself to let it die through neglect. He went to refill the pitcher in the bathroom down the hall.

It was the chartreuse sheet of paper taped to the door of the bathroom that reminded him that he had refilled the pitcher just that morning. He distinctly remembered seeing the flyer advertising a band he'd never heard of playing at a local bar. The band's name, Five O'clock Shadow, had struck him as incongruous at seven thirty in the morning and . . . oh, never mind, the pitcher was empty and that was that.

Stuck in traffic on the way home an hour later, it came to him that the pitch-

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er held a quart and he knew for a fact that he'd used less than a fourth of it after filling it that morning, leaving . . . what, twenty-four, twenty-five ounces or so? Round that down to twenty, just to be on the safe side. Yet that same afternoon there had been only two or three ounces remaining.

He frowned. Call it eighteen ounces of water evaporating in one day—less than a day—six hours, tops. Must be some pretty dry air in his office to empty the pitcher that rapidly. No wonder the poor spider plant looked so bad.

The next morning, he was hailed as he was unlocking the door to his office. "Hey, Chris!"

Arken pushed the door open and reached inside to toss his briefcase on the visitor's chair before turning. "'Morning, Bob. How're you doing?"

"Great, man, great! We've finally managed to get that phase change to work." Bob Tindall had spent the past eighteen months trying to improve the efficiency and color temperature of LEDs.

"Then that means—"

"Exactly! We'll be able to get a true paper-white LED."

Arken stuck out his hand. "Well, congratulations! I'll buy you a beer to celebrate."

Tindall grinned widely. "Better you should buy one for Nigel. I'm telling you, that kid's going places. Best grad student I've ever had."

"One for each of you, then," Arken promised. "Tonight?"

Tindall squinted, staring at nothing. "Uh, yeah, that'll work for me—I'm free this evening. I'll track down Nigel and see if he's got any plans."

"Let me know if it's okay," Arken said. "I'm always open."

A brief look of sympathy passed over his friend's face. "Yeah, I know. But, hey, we'll get you out for some fresh air tonight." Tindall hurried off down the hall, leaving behind an intangible air of busy energy.

Arken entered his office. The first thing he did was to check the spider plant. Nicely moist soil and the plant itself had perked up. The pitcher was about as full as he remembered it being from the previous afternoon. The morning had dawned overcast and a light rain had begun as he'd driven into town. If the plant hadn't improved, he'd planned on setting it outside for a good soaking, but now he wouldn't have to.

He shrugged, picked up his notes, and left for his eight o'clock lecture.

Kenny Burton was waiting for Arken after class. "Professor, I know it's not office hours, but I wanted to ask you a quick question."

Arken reached in his pocket for his key and unlocked his office door. "As long as it doesn't take too long, Kenny."

He was speaking over his shoulder as he said this, but something in the student's expression made him turn. He blinked. Then blinked again. The glass in his office window had shattered, allowing rain to spatter in. Plaster had spalled off the outside wall in irregular patterns, leaving only bare lath. Part of the ceiling near the wall had collapsed. The room was a mess, with plaster dust everywhere, all over his desk, his papers, his . . . spider plant? It was dead. Absolutely, irrevocably dead. Brown, desiccated leaves had fallen to the floor from shriveled stems. How the hell could the thing be dead? It had been doing fine before he left to teach class.

Kenny gazed in wonder at the faint haze of dust hanging in the air. "Uh, Professor, if this isn't a good time, I can come back later." He paused, then finished hesitantly, "I mean, I know it isn't office hours . . . and . . . well, I'll come back later." He left hurriedly.

Arken stared at the remains of the spider plant. Truth be known, he'd come to the conclusion that the ugly thing was unkillable. To have it expire so quickly and completely was a boon from his point of view, but he had the sneak-

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ing suspicion that there was a price yet to be paid.

As fate would have it, that reckoning was to be sooner rather than later. "Chris?" came a feminine voice from behind him. "I've got your mail. Something came in that looked important, so I thought I'd bring it—"

He turned to see Marsha, the departmental secretary. Her eyes widened as she looked past him into his office. "Ohmigod! What happened?"

Arken shrugged. "I don't know. I just finished my eight o'clock and came back to find this." He gestured vaguely at the mess. "It must have happened within the last few minutes or the dust would have settled."

Her eyes locked on something and he knew with dreadful certainty what was coming next. "Oh, and the spider plant!" She turned hurt eyes on him. "Didn't you water it?" She pushed past him, leaving smudged footprints in the dust on the floor. She tested the soil with her finger and said in an accusing tone, "Why, it's dry as a bone! Men! Can't even take care of a simple plant." She flounced out, insulted.

"Maybe the plaster dust poisoned it," he said to her retreating back. The words sounded lame, even to him.

But then his eyes stole to the pitcher. It was empty. Nothing but a faint brown haze towards the bottom showed that it had ever contained water at all. And it had been over half full just before class.

Really dry air.

Maintenance showed up while he was still trying to dust off the papers on top of his desk. He knew the man vaguely, having spoken to him once about a flickering light in the corridor. Tom, Bill, Jack, some common name, but for the life of him he couldn't remember which one.

"*Whoa!* Good one, Prof."

As though it was something Arken had done on purpose. He caught himself on the verge of saying something rude to the man. "How long to fix it?"

From the way the maintenance man flinched, his tone must have been sharper than he'd intended. "Don't know, man. Never seen a wall let loose like that." He spent a minute prodding at the wall, causing more bits of loose plaster to fall, then turned to face Arken. "You'd better get your things together. We're going to have to see about moving you somewhere while we fix this. It's going to get messy."

Arken threw down a book in disgust. It raised a cloud of fine, choking dust, setting him to coughing. Clearly, the room was a health hazard. "*Get* messy?" he complained. "Looks like we've already achieved messy status."

The maintenance man nodded sympathetically. "Yeah, it'll be a pain, no matter how you look at it. We'll have to call someone in who does walls. All I can do is grab some plastic sheeting and put it over the window to keep any more rain from coming in."

Arken sighed. "Okay. Let me start packing things up."

Christopher Arken actually preferred that people use his full first name, but he could never bring himself to correct those who shortened it to Chris. It was a small matter in the great scheme of things, but all the same it annoyed him. His wife, Mindy, had called him Christopher from the first day he'd met her. In some mysterious manner, she had intuited his desire and had never once called him Chris. When she'd died, he'd found their home too choked with memories. He'd sold it and moved into an apartment, telling himself that it would be easier to clean.

The ease of cleaning aspect was going to factor heavily into his evening's work. He had a row of paper bags sitting on the floor. Plaster dust had settled over absolutely everything in his office and he'd brought home an assortment of cardboard boxes and bags containing all the books and papers and oddments

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that he had accumulated over his career. Every piece he pulled out of the bags sent more dust drifting through the air in his apartment. He had the vacuum going and was using the little round fuzzy brush attachment to go over everything. He'd already had to change the filter once and was on the verge of needing to do so again. It was amazing how fine the dust was.

Arken's back was stiff from hunching over for so long. The clock said it was after nine, which made it almost three hours that he'd been vacuuming things. It seemed like forever. Time for a break. After dropping a stack of cleaned paperwork on the kitchen table, he stepped across to the kitchenette and filled a glass with water. On his way back past the table, he happened to notice that the papers he'd cleaned were yellow in comparison to the pages of a novel he'd left open on the table the night before.

He frowned. Surely he'd done a better job of cleaning off the dust than that. Rubbing a finger on the yellowed sheets, however, did not produce much in the way of dust. Nor did it whiten the page.

Curiouser and curiouser. Arken pulled up a chair and sat. He took the top sheet off the pile and examined it closely. An ordinary piece of paper. It just happened to be slightly yellowed. Not enough to be obvious until it was seen against something white as a reference. Of course, the paper used in novels wasn't all that white—more of a light grayish-cream color. So if something appeared yellow compared to that standard, it must be really yellow.

He stood and went to his computer. Pulling a fresh sheet of paper from a ream sitting next to his laser printer, he returned. Seen against a new, white sheet of paper, the yellowing was even more obvious, trending towards the color of parchment.

Okay, so what yellows paper? Well, exposure to chemicals could do it. Nitric acid, perhaps hydrochloric . . . but there had been no smell in his office, and either would have left a pungent calling card. Rephrase the question: What is odorless that would yellow paper? That took a moment's thought, but ultraviolet light seemed like a good candidate. So where would the ultraviolet light come from? The fluorescent lights in the ceiling? True, fluorescent lights put out some UV, but not enough to yellow paper in a matter of days. And short of applying the entire output of the lights as heat, there was absolutely no way they could evaporate a nearly full pitcher of water in a mere ninety minutes.

Which left him with a yellowed piece of paper, a failed hypothesis, and a large pile of dusty things that still needed vacuuming. He shrugged and went back to work.

As fate would have it, word of his mishap had spread among his students and in consequence Christopher Arken acquired a great deal of perverse interest. A greater than usual number of students—including several he was certain needed no help with physics—came to office hours in his new "office" which was, in fact, a hastily cleaned out storage room on the third floor. Most of them were content with one visit, but each had to be seen, regardless of whether they were there with serious questions or not. Fortunately, the novelty wore off quickly.

What didn't wear off so quickly was the discomfort and inconvenience of being shoehorned into a narrow space that barely provided enough room for him to push back from his desk. Arken was getting quite a collection of bruises on his shins from maneuvering around the desk on the way in and out. His books had been haphazardly stored in a motley collection of cardboard boxes that now lined one wall of the storeroom. His student visitors invariably chose to perch on the cardboard boxes rather than sit in the awkwardly positioned visitor's chair, leading to a certain amount of

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wear and tear on the boxes. Arken could only hope that the books inside the boxes were taking the punishment gracefully.

He'd been in too much of a hurry on the way in to work that morning to stop by his old office and check on progress, so when lunch finally rolled around he walked down the nearest flight of stairs. Luck was with him and the red-headed leader of the workmen was just leaving, pulling the door to behind him.

Arken explained who he was and asked for an update. The red-headed man pushed the door open and showed him the naked lath. "We finished getting the plaster off the wall this morning. Normally, we'd leave anything that was sound, but in this case, we're going to put up wallboard, so we wanted the lath completely clear."

"So what happened?" Arken asked.

"Well, when the brick let loose, it—"

"Wait a minute . . . what brick?"

The workman raised an eyebrow. "You didn't know the brick fell off the outside of this wall, here?"

Arken shook his head. "No, this is the first I've heard of it. I wasn't in here when it happened and I don't normally walk around that side of the building."

"And no one told you? Huh! Okay, the brick on the wall outside your office broke apart and fell. Not entire bricks, just the outer half-inch or so. Split away from the wall and fell to the ground. An area about fifteen feet in diameter. It is, bar none, the single weirdest thing I've ever seen. One brick—okay, you might could see how one brick might have had a crack in it or something, but for a whole round section of the wall to let go . . ." He shook his head in wonder. "Anyway, the vibration from that must have been what knocked your plaster down. Broke the window, too, but that's already fixed. Had a glazier come by and put new glass in."

"Wow, I'm glad I wasn't in here when it happened. Probably would have scared me to death," Arken said.

The man nodded in agreement. "I imagine so. Anyway . . . got some masons coming to tear out what's left of the old brick and put in new. 'Course, it won't look the same, being as how it's impossible to match old brick like you've got here, but at least it'll keep the weather out. They're worried that the cement will have let go—the rest of the brick might just up and fall out entirely one of these days."

"So how long will it take to get all this back together?"

The workman scratched his head. "Lemme see. Take another day to get the wallboard up and tape the joints. In a house, we'd take longer, but an office like this we just slap-and-go."

Arken grimaced. "Sounds encouraging."

"Hey, man, we offered to do the full do-rah, but they just wanted to get your room back together as soon as possible."

"And paint?" Arken prompted.

"Oh, yeah. That'll be another couple days." He patted the doorjamb. "We should have you fixed up by next Tuesday or so. Wednesday at the latest. I'm not sure when the brick guys are getting here, but other than some noise and people outside your window, there's no reason you can't move back into your office as soon as the paint's done. It's not like you're running around naked in here or anything, so as long as you aren't worried about privacy I'd say that you can plan on being back in here the middle of next week."

Arken thanked him and left.

Part of him was glad that the workmen would be done sooner rather than later. The other part was miffed that the department didn't consider him worth however much extra money it would cost to get the "full do-rah," whatever that might mean.

The bright side was that he'd secretly been wishing they would paint his office for several years now. Willy-nilly, he was going to get new paint. He just

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hoped that they chose a tasteful color.

Knowing that his office would be back in service soon made the cramped storage space easier to tolerate. His exile to the third floor became more like a camping trip—a temporary privation to be proud of, rather than something to complain about. Arken was already practicing lines in his mind, simple throwaways like, "Oh yes, back when my office wall exploded . . ." After all, it wasn't a tale that his colleagues could easily match. *Their* lives were unutterably boring and mundane, unlike *his*. After all, *who* among them could brag that *their* office wall had collapsed? Put in those terms, it all seemed rather silly, but it brought a smile to his face nonetheless.

With that, his mood improved and he started finding humor in the situation. He welcomed the students who dropped by during office hours with an airy, "Enjoy the view," even though the storeroom had no window. He got some strange looks, but a few went along with the gag, pretending that they could see through the wall all the way over to the center of town, nearly two miles away.

He had never spent much time on the third floor. Nothing against the place, it was just that he wasn't in the habit of climbing the extra flight of stairs unless there was a need. Now that he found himself on third with a few extra minutes to kill before his Thursday 11:00 lecture, he thought it might be interesting to take the long way around and tour the floor.

Phillips Hall, the physics building, had originally been two separate, parallel buildings back in the early twentieth century. The long axis of the buildings was east-west. In 1957, the two buildings had been joined across their eastern ends with a new, third wing. At the time, the building had been a marvel of modernity, but now it was a worn-out shoe that no longer fit twenty-first century science. Any research that required more than a modest amount of electricity was restricted to either the dank basement or the first floor. The ceiling had been almost completely removed from the basement, allowing orderly ranks of electrical conduits to run along the joists, either to the basement laboratories, or to the floor directly underneath the first floor labs.

Christopher Arken had been assigned a second floor office in the south arm of Phillips Hall for exactly that reason. He was a theoretician, not an experimentalist, and was content with a functioning computer terminal. It worked to his advantage, in that he was graced with a view of the outside world, even if it was bounded by the north arm of the building. He was not one to complain that the walk running between the two wings and through the east wing was a favored route for the coeds living in the dorm just to the west.

Other than the purely practical division between theoretical and experimental work, there was neither rhyme nor reason to the assignment of offices, either by floor or by wing. Eigen was here on third, helping to raise the temperature of effective superconductors. Sanchez was on first, but in the other wing, doing much the same thing, though from an experimental point of view. Wellington was tucked down in the basement, diddling with time. First floor had Marchall-Wingert and his elaborate vacuum chamber, playing with vapor deposition of alloys on ceramic substrates in an attempt to create new semiconductors. When he'd first arrived, Arken had wondered why people weren't arranged in a more logical manner. As time went on, he saw that it was part random availability as offices came open and part inspired cross-fertilization to keep researchers from growing stale.

Arken walked along the hallway, noting that it was almost a carbon copy of the second floor. No surprise there. The east connecting wing was sufficiently different in design that it stood out from

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the south and north wings, both on the outside and inside. Although somewhat newer, the rooms were smaller and newer members of the faculty were assigned offices here, side-by-side with display cases full of dusty old cloud chambers and poorly labeled X-ray diffraction prints.

The north wing was mirror-imaged from his. Looking through an open office door and out the window, he saw the ivy-covered wall of the south wing. Sure enough, there was a raw scar where the brick had come apart. The newly exposed inner surface of the brick was clean and notably lighter.

Glancing at his watch, he found that he'd taken longer to tour the third floor than he'd intended, and would have to hurry to get down to the first floor lecture hall on time. Something bothered him as he trotted down the stairs, but he couldn't quite put his finger on it. He chalked it up to the trouble with his office and forgot about it.

Christopher Arken heard the siren midway through his lecture. It came from afar and got quite close before it cut off—close enough that his students began glancing at one another and the doors leading out into the hall, as though expecting emergency personnel to come bursting in at any moment. No one interrupted them, however, and they went back to the Lorentz contraction equations without further interruption.

When class ended Arken left for his office, but ran into Bob Tindall before he'd made it ten paces down the hall. "What a week, Chris! First your office falls apart, and now this."

"Now what, Bob?"

Tindall's eyes opened wide. "Oh, wow, you haven't heard? Guy died in your office, not half an hour ago."

"*Died?* Who died?"

"One of the workmen doing the wall stuff."

Arken was shocked. "What happened? Did he fall off a ladder or something?"

"They don't know. It's complicated. The room's a mess and the guy, well, they say he looks pretty bad."

"Of course the room is messy, it's a construction zone."

"Chris, the wall exploded."

Arken shrugged. "I don't know that I'd go so far as to say that the wall actually exploded—all that happened was that the plaster fell off. That's why they're putting up new walls."

Tindall said very slowly and carefully, "Man, your wall exploded. Today. Just a little while ago. I'm not making this up. Go see for yourself."

When Arken got to his office, there were campus police, city police, and paramedics all crowded into the room. There wasn't room for him to enter.

A female officer looked up and saw Arken standing in the door. "I'm sorry, sir, but you can't come in here. Move along, please." She was already moving to eject him from the scene.

"This is my office," he said simply. "Or at least it was until the walls needed repairing."

Her eyes narrowed. "Did you know this man?" she asked, pointing at the floor.

Arken craned his neck to look between some of the people standing around the body. He was shocked by the body's condition, but forced himself to concentrate on the face. "It looks like—maybe—the man I talked to yesterday, but I can't be certain. He wasn't . . . uh . . . well, he didn't look like that."

"According to the driver's license in his wallet, his name was Patrick MacGillivray. Does that name mean anything to you?"

Arken shook his head. "No. I never got around to asking his name."

"You said this is your office?"

He nodded.

"Did you keep anything explosive in here?"

"Explosive? No . . . why would I?"

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The officer looked up from the notes she was taking. She waved her pen vaguely in the air. "You're a physicist. You might be doing an experiment."

Arken had run into this before—the blind assumption that scientists routinely blew things up just to put some excitement into an otherwise boring day. "Uh, no. All the labs are down in the basement or first floor. If there's anything explosive in the building, it would be downstairs. Nobody keeps anything rough in their office."

"Care to explain how this could happen?" she asked, using her pen to point at the nearest wall. Her tone was just shy of accusatory.

The body on the floor had consumed all of Arken's attention so far. Now he saw that large, gray sheets of what he assumed were wallboard had been put up, but the seams between adjacent panels were ragged and torn, as though they had indeed exploded. There were rows of circular divots out of the interiors of each of the panels as well, each with a black screw head exposed in the center of a ripped area.

He squeezed past a paramedic to closer examine the wall, then turned back to her and said, "I have no idea. As I understand the process, they hold up the sheets of wallboard, use screws to fasten them into place, then use some kind of glop to smooth over the heads of the screws and the edges of the boards. Looks as though some sort of chemical reaction took place and it exploded, although I have no idea how that could happen. I don't know what's in the stuff."

"If you ask me, it looks like pudding, but the tub says it's called joint compound. The label on the side of the container says it's mostly crushed limestone and gypsum," she volunteered. "That help any?"

He thought for a moment. "Those are both pretty stable compounds. I can't see any reason why either one would explode."

She questioned him for a few minutes longer, but it was perfunctory by that point. She'd already ruled him out as a suspect in whatever crime she thought had taken place. Her last question, however, took him by surprise. "Can you think of anyone who might want to kill you, Mr. Arken?"

He turned from examining the frayed edges of the wallboard and gave her his complete attention. "Are you suggesting this was murder?"

"It's a possibility, sir. This is your office. Under normal circumstances, you might have been in here this time of day. That," she paused to point at the body on the floor with her pen, "could have been you."

And that put an entirely different slant on things.

Christopher Arken walked slowly towards his temporary office, numb to the external world. The police officer's suspicion that someone might be trying to murder him was worrisome, but with a man lying dead on the floor in his office, it was difficult to ignore the possibility. It would be one thing if it was just ugly graffiti scrawled on his door, as had happened to a colleague of his, but death . . . that was a another matter entirely.

He decided that he was in no condition to teach a class, taped a note to the door of the classroom to notify his students that it was canceled, and went for a walk. Without any particular destination in mind, he simply went out the nearest door and wandered aimlessly around campus. The idea was bizarre. Murder was something that happened to other people. He hadn't had an affair with anyone's wife. He didn't owe anybody money. He hadn't shafted anyone on a drug deal. He didn't know anything about top secret government research projects. He kept circling back to the unbelievability of it, then would realize yet again that a man had died in his office, wonder how it had happened, come to the point in the conversation

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where the officer had suggested the possibility of murder—her facial expression was stuck in his mind—only to return to the impossibility of it all. Round and round in circles. If he managed to get off the endless treadmill, his mind went to the mysterious manner in which the workman had died. Arken was also beginning to feel a latent sense of guilt that an innocent man might have died in his place. Not that he wanted to die, but if some innocent third party had been killed in an attempt to murder him, it was going to be hard to live with.

It wasn't until he was halfway across campus that it occurred to him that he was a rather conspicuous target if someone actually was trying to kill him. Being out in public offered a sort of protection, but hardly enough for him to get complacent.

He turned around and started back towards the physics building, moving more rapidly, hating himself for the helpless dread that he felt. He couldn't live his life in fear. He had to know if there was actually someone trying to kill him and if so, why.

He was approaching Phillips Hall from the west. Involuntarily, his eye strayed up to the window of his office. The shattered brick on the outside wall was immediately obvious. He stopped so suddenly that a young man crashed into him from behind, muttered an apology, and went on, intent on his own problems. Arken stood and stared at the pieces of brick on the ground, some a fair distance from the wall. Broken brick, fallen plaster, exploding joint compound, and a dead man. And no obvious connection between the various facts.

Arken took a deep breath and told himself to get a grip. There had to be some connection. Things are only mysterious until they're explained. Afterwards, it's easy to see how it all fits together. The trick is to find the links that complete the chain of events.

He studied the wall outside his office carefully. It wasn't until he turned to face the north wing that the first piece of the puzzle fell into place. There was a small patch of dead ivy at the base of the north wall, almost exactly opposite his office window. Not just dead, but positively scorched. Arken approached the telltale dead spot cautiously, wary that it, too, might explode or do something unexpected. Nearly buried in the ivy was a window, just above ground level. Glancing up and down the length of the wall, he marked the spot in his mind and entered the building through the door in the end of the north wing, a suspicion growing in his mind.

He had paced the wall as he retraced his steps. Now he paced off the basement hallway until he was approximately even with the dead ivy outside. There wasn't a door there, but there was one a few paces behind him. He opened it quietly and slipped into the lab.

There were a half dozen standard 19-inch equipment racks side by side to his left, each full to capacity with electronic gear. Another five racks stood against the wall in front of him. In the center of the room was what appeared to be an optical bench pressed into service as a test bed. Bolted to the metal top of the bench was a tripod supporting a cylindrical stainless steel cylinder with cables going to it from the equipment in the racks. There were also what appeared to be cooling lines.

"Ah, Chris! How're you doing today?" boomed a voice from the corner. "What brings you to this dim and dusty corner of the dungeon?"

Even now he wasn't certain, so Arken proceeded carefully. "I wanted to see how you were getting along with your stasis games."

"Doing well. Real well. In fact, we've been at it hammer and tongs for the last three or four days now, working around the clock. I sent Chu home a little while ago. He's been up for something like thirty hours straight. So have I, for that matter, but it's hard not to be excited

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when you're finally getting results."

Arken spied a small pile of greasy cardboard pizza delivery boxes next to a trash can filled to the brim with stained paper coffee cups and soda cans. "Eating well, I see. And a firm believer in the caffeine diet, too."

Mark Wellington stood, stretching, as he unfolded himself from behind the rack he'd been crouched behind. "Oh, man, that feels good!" He reached up and grasped a heavy metal conduit overhead, then lifted his feet free of the floor and allowed himself to swing from his fingertips. An impressive array of pops and crackles sounded as his vertebrae settled back into place. He grinned. "Who needs a chiropractor, anyway?" He got his feet back under himself and gestured at a stool. "Sit! Sit!"

Arken warily hitched himself up on the stool, still unsure whether he wanted to be here or not. "Let's see, I talked to you about two, maybe three weeks ago. At that point you thought you were going to be able to get up to a one centimeter diameter stasis field by the end of the week."

Wellington ran his hands through his hair, causing it to stand upright for a moment before it fell over. "The best laid plans, and all that. If you'll pardon the expression, this ain't your father's concept of time we're working on, and the more we pick at it, the more we realize what a hairball the whole thing is. When you and I talked, I was still hoping for a general stasis field. I had a field a little under a millimeter in diameter, but things were acting unpredictably. Parts of the field would enter a pure, complete stasis, where time would stop. Other parts would slow down somewhat, or not at all. All very random, or so it seemed at the time. Chu and I nearly beat ourselves to death trying to figure out why the field wasn't uniform." He took a deep breath and let it out as a long sigh. "A little more work and it turned out that we weren't getting a general stasis field at all. Certain molecules were more affected than others."

"I'm not sure I'm following you. How can you slow down time for some molecules, but not for others? I thought everything in the field was supposed to slow down at once . . . all at the same time . . . er, to the same degree." He gestured in frustration. "Oh hell, you know what I mean."

"That's what we thought. It does seem reasonable, doesn't it? Unfortunately, it doesn't seem to work that way. We began tuning the thing and found that we could actually select which molecules we wanted to put into stasis. Meanwhile the other ones just keep right on truckin', just as though nothing was happening at all. I mean, we'd already thrown out everything we thought we knew about time in order to get that far, but at that point we had to start all over yet again. It's fascinating, I tell you. What we're doing now is trying to plot some of the more obvious molecules—"

"Like water," Arken put in, as another piece of the puzzle fell into place.

Wellington nodded excitedly. "Yes, yes, water! We hunted around and found the tunings for nitrogen, oxygen, carbon dioxide, and a few other things, but water is the one we've been playing with the last week or so. We've just about got that one licked. Once we get a good idea of the tunings for all the prominent molecular players, we intend to modify the system to produce a broadband noise field instead of a single, discrete frequency. Right now we don't know how much bandwidth will be required—it may be one order of magnitude, or it may be several. Anyway, once we get that question settled, we hope to achieve a true stasis for everything in the field."

Arken nodded in turn, lost in thought. "Mark, let me ask you something. Your stasis field takes time out of the sample, right?"

"In a manner of speaking, yes." He paused, staring into the distance, choos-

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ing his words as he went along. "It serves as a receptacle for time . . . somewhere where time would prefer to flow, rather than through the sample in the stasis field."

"Then answer me this one, last question. Once you've removed the time from your stasis field, where do you put it? It doesn't just disappear, does it? There must be some place in your mechanism where you radiate the excess time."

"Oh, sure," Wellington said, hooking a thumb over his shoulder towards the wall behind him. "That's back here. The damned thing was getting really, really hot, so we put it next to an open window and let some of that chilly autumn air in to cool it off . . ."

"We don't appreciate you trying to solve this on your own, Mr. Arken," the police officer said with obvious disapproval.

"It wasn't so much that I was trying to solve it. It's more that the answer just sort of fell into my lap," Arken protested.

It was the same female police officer he'd spoken to earlier in the day. Frankly, he didn't like her, and wished that she would simply go away. However, she seemed determined to make him sweat. She scowled at him. "And so you noticed the dead ivy and went to talk to Mr. Wellington," she prompted.

"Professor Wellington," he corrected. "I didn't know it was him, it was just a question of—"

"It was just a question of you counting paces until you located the laboratory behind the dead ivy. That sounds an awful lot like a conscious attempt to solve—"

"Look," Arken said, allowing a bit of annoyance to creep into his tone, "you were the one who jumped to conclusions and decided that someone was trying to murder me. I think it's natural that I might take an interest in the matter."

She moderated her tone somewhat. "All right. Fine. So you went into his laboratory and discovered him hiding behind some equipment."

"Look, Officer, I've known Mark Wellington for years. We're not best friends, but we're on good terms. He may be guilty of negligence, but he certainly didn't set out to murder anyone. He was just trying to get his stasis system to work."

"And this stasis thing is supposed to stop time, right?" she asked.

"Right. But it wasn't stopping time for all the molecules in the field. Only for some of them. So he was trying to modify it so that it would work equally on everything."

"I still don't see the link between that and what happened in your office."

"He discovered how to tune the stasis field for water molecules. Water is common. It's inside you and me, in the ivy, in the air. It's everywhere. Once I saw that, everything else fell into place naturally."

She couldn't bring herself to ask outright, so she prompted him instead, "And that was . . . ?"

"Water was the key to the thing from the very beginning. The water in the pitcher in my office evaporated during the course of a single class period. Time in the stasis field had slowed down for water molecules in his lab, but for things to remain in balance, time had to speed up for water molecules elsewhere. That just happened to be my office. The destiny, so to speak, of the water in the pitcher in my office was to evaporate. The backlash from Mark's stasis field simply made it happen more quickly. *Much* more quickly. Due to inherent inefficiencies in the system, even more time gets expended on the back end than gets removed from the sample. It's an entropy thing."

"But what happened to the joint compound—" she began, then paused, "Wait . . . you're going to tell me that it was because it was wet—that there's water in the joint compound."

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Arken nodded. "The water content of the joint compound was going to evaporate, just more slowly. Under normal circumstances, it would evaporate over, say, twelve hours. There would be plenty of time for the water molecules to work their way to the surface of the joint compound and from there into the air. When the water tried to evaporate so quickly, there was no easy way for the water vapor to escape, so it expanded in place and burst the joint compound, as though it had boiled and turned to steam. Something like what happens if you try to fire pottery before it's completely dry. Some of the moisture had soaked into the wallboard, and it burst apart in the same way. That's pretty much the same thing that happened to the brick on the outside of the wall. It was raining the day the wall came apart. Enough rainwater had been absorbed into the brick—brick is more porous than you might think—that it simply blasted the brick apart."

"And the ivy?"

"That's a little more complicated. The water molecules in the ivy would normally have undergone metabolic reactions that kept the plant alive. If everything had sped up at the same rate, the plant might have survived, but only the water sped up. It would be like trying to dance the jitterbug with a partner who wants to slow dance. It simply won't work. The plant died as a result."

"The same thing that happened to the workman in your office."

"Mark and Chu were turning their system on and off as they tried different tunings and configurations. It was bad luck that he was in my office when they decided to try a full power test. Trust me, Wellington feels terrible about what's happened. He's been working day and night in his lab trying to get this going and hadn't heard about anything that's happened."

She gave him a look that clearly said, "So scientists really do blow things up." Aloud, she added, "And assuming that this was all an accident, as you say, then—"

"By all means, talk to Mark. I'm satisfied that it was nothing more than a tragic accident."

"You're not investigating Patrick MacGillivray's death, I am. I'm the one to be satisfied that it was accidental, and if I'm not, then he's going to have to try to convince a jury. What you think is immaterial."

Arken held up his hands. "You're right. Investigate away."

She gave an irritated huff. "Now, as I was saying, assuming that this was actually an accident, is there some way to make this thing safe?"

"It'll either be made safe or Mark will take his apparatus elsewhere to work on it. He's already looking at the design of the time sink, trying to figure out how to make the time that comes out of it more diffuse."

"He'd better succeed. I'll be talking to him as soon as we get done, which is to say, now." And with that, she abruptly left.

The smell of paint was strong, but Christopher Arken's office was ready, and he did not intend to waste any time moving back in. Surprisingly, he'd found a new desk and one new bookshelf when he first let himself in. The desk was nice, but the bookshelf didn't match the others. Why they'd replaced one—and one only—he wasn't sure, but as long as it held books he wasn't in the mood to complain. He was tired of his "camping trip" on the third floor and getting resettled into his old office felt like coming home.

He had just started unpacking the fourth box when he heard a polite tapping on the doorframe. He looked up to find Marsha standing there holding a small pot with a cactus in it. "I thought that I would give you something that could stand a little inattention, since the—"

"It wasn't my fault! Honest. Mark's sta-

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sis field—"

She nodded, smiling. "I know, I know. I was just teasing you. Still, I thought that I'd get you a little something to make the place feel more like home."

"Uh, Marsha, you didn't have to do that."

"Think of it as a housewarming gift."

There was nothing to do but give in gracefully. "Thanks."

She glanced around warily. "So tell me, is it going to be weird being in here knowing that a man actually died right where your desk is? I mean, it would creep me out."

"He seemed like a decent guy, but it's not as though I actually knew him. I only talked to him the one time. I'm sure it's rough on his family, though."

She nodded. "I hear that they let Mark off the hook."

"It was an accident. It's horrible that someone died, but it wasn't something Mark did on purpose. He's got a new technology by the tail, and there's a lot to learn yet. He and Chu just didn't realize that their stasis field had the potential to kill. Now they know. It was the worst sort of way to find out, but . . ." He shook his head. "It's over now. Mark will be more careful, and things will be okay."

"I sure hope so," she said. "I'd hate to sit in here knowing that you're in the cross hairs of something like that. It'd scare me to death."

And that was the crux of the thing—cross hairs.

Christopher Arken stood at the window, looking thoughtfully at the dead ivy at the base of the wall of the north wing. It was a good fifty feet if it was an inch. And yet the waste time that Mark Wellington had been getting rid of had reached across the intervening space with enough force to blast a wall and kill a man.

No one had ever given it much thought before, because no one had ever managed to concentrate time; it had always been homogeneous. But now that Wellington had managed to manipulate time, it turned out to have some characteristics in common with electromagnetic waves. By all rights, the waste time from his test apparatus should have obeyed an inverse square law and dissipated to such an extent that it was harmless by the time it hit the wall outside his office. It hadn't. In one of those cosmic flukes like the discovery of vulcanized rubber or penicillin, Mark Wellington had serendipitously designed a time sink that radiated time in a tight beam. Arken doubted that it was an optimal design. That would come later . . . after the government got involved.

And that was only a matter of time because, in effect, Mark Wellington had created a death ray. ■

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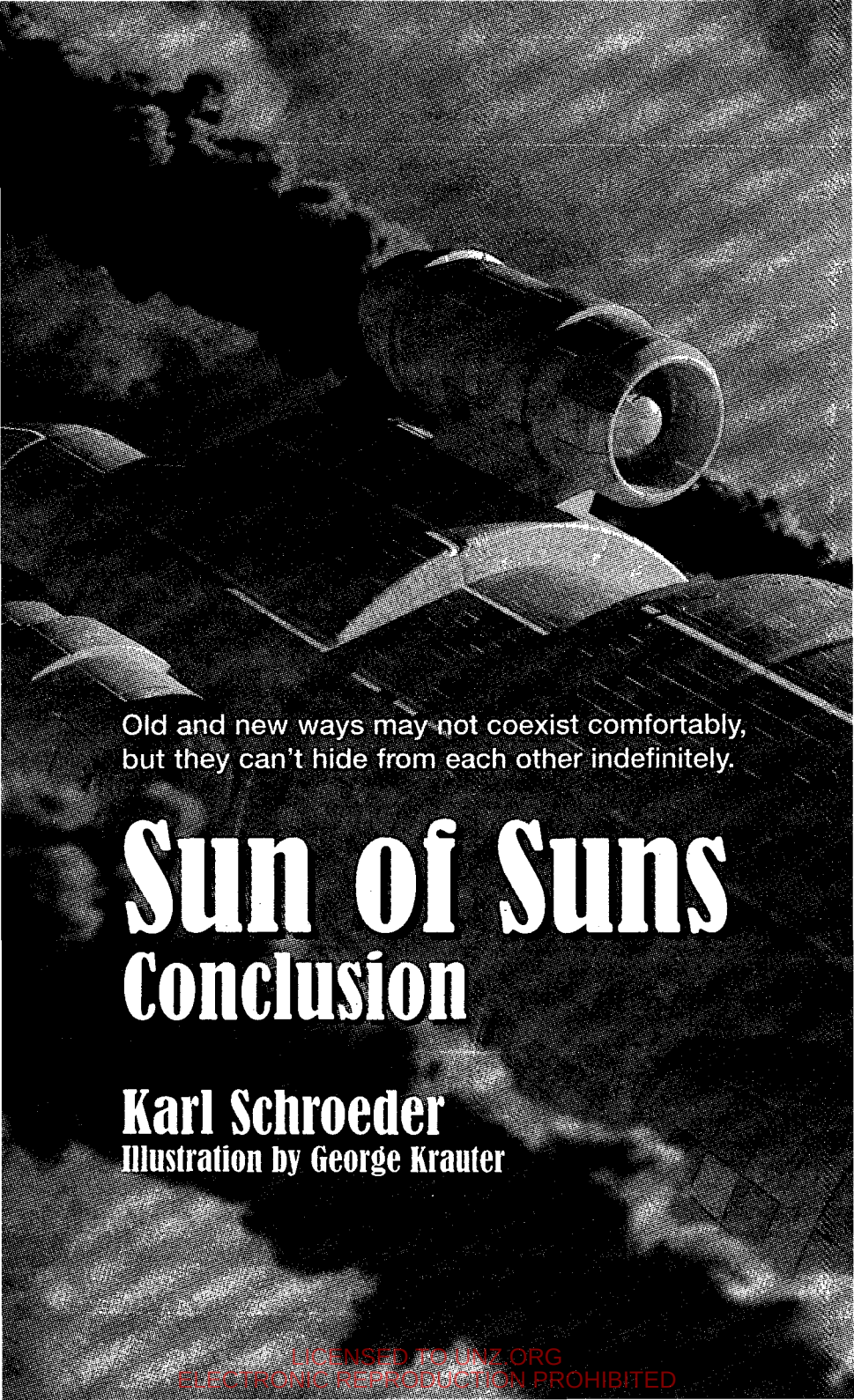

Old and new ways may not coexist comfortably, but they can't hide from each other indefinitely.

Sun of Suns
Conclusion

Karl Schroeder
Illustration by George Krauter

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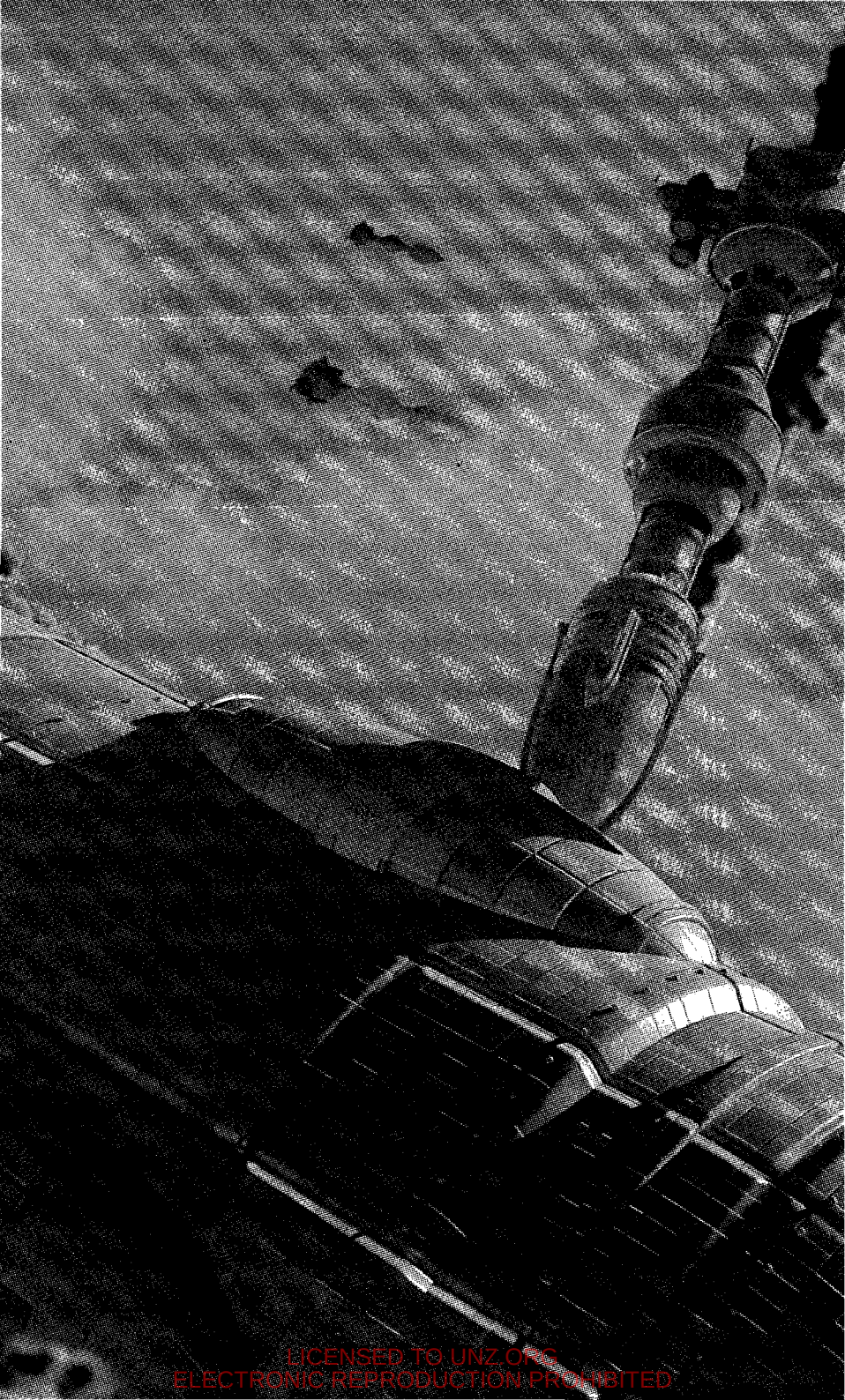

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The story so far . . .

Imagine sky with no earth: clouds dot the blue, receding to infinity in all directions. To one side a distant sun casts its light across hundreds of miles, sending shafts of shadow radiating from the clouds that surround it. Opposite it, the blue fades to black. There is no gravity here—rocks twirl and balls of water undulate in the chill air. Spinning in the middle distance is a wooden wheel two hundred feet in diameter, its inside surface paved with buildings. And inside one of these buildings, young ***Hayden Griffin*** *is sulking.*

Hayden is oblivious to the strange beauty that surrounds him. He's lived his whole life here in Virga and is unsurprised at a world where you have to make your own light, heat, and gravity. Virga is a fullerene balloon five thousand miles in diameter, filled with air, tumbling rocks, and water—about a Pluto's worth of volatiles. This artificial habitat orbits alone in the outskirts of the Vega star system; but Hayden knows nothing of that. He's spent his entire young life focused on the political struggles of his own nation, Aerie, in its fight against invading forces from the migratory country of Slipstream.

Hayden's mother is part of a secret project being undertaken here on the edge of darkness. She is part of a resistance group fighting for Aerie's independence. Since Slipstream destroyed Aerie's nuclear fusion sun ten years ago, Aerie has been utterly dependent on Slipstream for light and heat. An engineer, Hayden's mother has come here to the cold edge of Winter to build a new sun for Aerie.

An ominous note enters the ordinary day: it is the sound of approaching jet engines. Hayden runs outside in time to see a fleet of Slipstream warships approaching. The secret project has been discovered. Soon the air is full of snarling jets, each can-shaped engine surmounted by a saddle and gun-toting rider. Dogfights surround the town and the glittering, half-built sun floating a mile away. Determined to help his mother and the resistance, Hayden impulsively mounts one of the town's jets (which are called bikes) and dives into the conflict. He is too young to control the massive bike, however, and it crashes into an approaching warship.

As Hayden spins helplessly into the unlit airs of Winter, he sees the new Aerie sun explode, with his mother inside.

Time: eight years later. Place: the city of Rush, capital of Slipstream. ***Venera Fanning****, wife of the admiral of Slipstream, enters the ladies' lounge of the admiralty, leaving her manservant outside. This is one of the meeting places for the spy network she runs. The men she meets show her some photographs that indicate a military buildup in the neighboring nation of Falcon Formation. Disturbed, Venera goes to warn her husband.*

Her manservant is none other than Hayden Griffin. He has infiltrated the Fanning household with the intention of killing ***Admiral Fanning****, whom he blames for his mother's death. Despite his determination, he keeps finding reasons to put off doing the deed.*

That night, there is a sneak attack on Rush while Hayden is wandering the streets of the city. Another of Slipstream's neighbors, Mavery, is blamed—but Venera and her husband Chaison know that Mavery is conspiring with Falcon Formation. The trouble is, they can't convince the government, which has decided to send the Slipstream fleet into Mavery. With the fleet distracted, Falcon will mount an attack on Slipstream. If they are to save Slipstream, they will have to do something themselves—something audacious.

While husband and wife debate, Hayden sneaks up to their office, knife in hand. But at the crucial moment, he is unable to act. Venera sweeps out of the office and, spotting Hayden, orders him

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to get his things together. They are leaving tonight. Paralyzed by indecision and doubt, he dumbly nods before retreating in shame and frustration.

So it is that the next day, Hayden finds himself boarding a Slipstream cruiser behind Venera Fanning. As they leave Rush to great fanfare, he meets some of the other members of the expeditionary force. One is the ship's go-fer, the weasel-faced boy ***Martor****. Another, the new armorer, is a beautiful young woman named* ***Aubri Mahallan****.*

Seven ships, led by Admiral Fanning's, break off from the main group. Despairing and mystified, Hayden watches as the sunlit realms recede. He, the Fannings, and his new crewmates are headed at full speed away from Slipstream, away from Mavery, and away from Falcon Formation—and into the fathomless darkness and cold of Winter.

Venera has hired Hayden as a driver, so to keep busy he decides to shake down the bike she's supplied for him. With Martor in his sidecar, he eases out of the Rook's *hangar and into the blackness of Winter. He doesn't want to think at this point; any action will do to keep himself from contemplating his situation.*

He takes Martor on a ride through the clouds. We've seen glimpses of the skies of Virga, but now the heavens open up and though it's dark as night, a deep indigo glow leaks in from all sides, illuminating clouds, balls of undulating water, and occasional drifting rocks. Hayden takes the bike up to two hundred miles per hour and they easily outpace the seven ships of the expeditionary force.

It's lucky that Hayden does this, because as he's arrowing ahead of the expedition, he suddenly sees a reflection of his own headlight gleaming back at him. He stops the bike just in time to avoid running into a wall of dark water—but isn't quite fast enough on the horn to warn the rest of the ships. One of them, the Tormentor, *plows right into the miles-wide ball of water that's drifted into their flight path.*

As the airmen dig the Tormentor *out of the quavering water, somebody spots lights shining in the depths of the teardrop ocean. Hayden lets slip that he knows what this place is: during his exile in Winter he'd heard of the town of Warea, which is situated in the hollowed-out heart of a giant ball of water. When Admiral Fanning learns that he's familiar with the place, he orders Hayden to join the small group going into the ocean to negotiate for supplies to repair* Tormentor.

Hayden seizes the opportunity to send a message back to the resistance in Rush. As a result of this, he will have cause to wonder whether he is the cause of the catastrophe that follows.

Repairs complete, the ships continue on their way. Hayden and Martor get to know Aubri Mahallan, the ship's armorer, as she gets them to help her with some odd electrical devices she's building. It turns out that Mahallan is not from Virga, but is a visitor from the strange universe outside the giant balloon. She doesn't like to talk about her past, though—and as a man with secrets himself, Hayden doesn't press. But he finds himself powerfully attracted to her.

A few nights into the voyage their conversation is interrupted by the onset of a strange phenomenon: a very faint gravity is being felt by the ships. Their engines labor as they pass near the skin of Virga itself. This is a region of giant icebergs that cling to the sub-zero skin like icicles. They have come as far from Candesce—the giant sun of suns that reigns over the core of Virga—as you can get. Beyond those icebergs lies vacuum and the strange civilization of Artificial Nature, Aubri's home.

Fanning has brought them here to visit something Aubri calls the "tourist station"—some sort of settlement of visitors from Artificial Nature. Poking his head out a porthole, Hayden can see its

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lights twinkling in the distance.

Suddenly rockets streak out of the darkness. The expedition is under attack. In the chaos that follows, the ships are separated as black-hulled pirate vessels loom out of the mist. Both the pirates and the Slipstreamers spew mines into the air in an attempt to limit mobility; but the pirates have the advantage of knowing where the icebergs lurk in the cloudbanks. Their ships soar out of the mists, fire off a salvo, and retreat before the Slipstreamers can line up on them. And they outnumber Admiral Fanning's ships.

Hayden sees that things are going badly. He tries to convince Aubri Mahallan to escape with him; on his bike they can make it to the tourist station easily. She rebuffs him, displaying surprising loyalty for her Slipstream employers. Hayden has no chance to run in any case, as Fanning sends him out to clear mines instead. With Martor's help he succeeds in blowing several icebergs away from Virga's skin and two pirate ships collide with one. But meanwhile the Rook is being boarded.

When Hayden tries to leave the struggling ship behind, Martor knocks him out and tries to fight off the pirates single-handedly. But it's too late. He, Admiral Fanning, ***Carrier****, and Fanning's aide* ***Travis*** *end up locked together in a cage aboard the Rook. Venera, meanwhile, has shot the Rook's captain to keep him from firing the ship's scuttling charges. She too is captured and abused by* ***Dentius****, the pirate captain.*

The prisoners talk to pass the time. Fanning lets slip that the expeditionary force has not come here to Winter to fight Falcon Formation—at least, not right away. No, it turns out that they came to the tourist station to retrieve a map—a map that may lead to a fabled hoard of pirate's treasure.

He has no time to explain further as the pirates come and open the cage. It is time, they say, for the executions.

The leader of the pirates, Dentius, was once a captain in the Aerie navy. He has a grudge against Slipstream and is determined to get his revenge. Killing the captive crew of the Rook *will also provide him a much-needed distraction, to help cover the fact that he lost so many ships in the battle with Chaison Fanning's expeditionary force.*

His chosen method of execution is barbaric but spectacular: he ties the Rook*'s crew—including Hayden, Chaison and the others—to the outside of the* Rook*, then has them doused with kerosene. He will set them on fire as the ship gets under way. Both Aubri and Venera try to talk him out of this course of action, but he won't be dissuaded.*

Black shapes suddenly loom out of the darkness—but it's not the other pirate ships. The five remaining vessels of Fanning's expeditionary force quickly encircle the Rook*, cutting off any escape.*

Dentius laughs. He holds all the cards, he tells Venera confidently. If the other ships open fire on the Rook*, they'll hit their own men, who are draped over the* Rook*'s hull as a human shield. If the Slipstream ships don't agree to back off, he'll start slaughtering the prisoners.*

But it's Venera's turn to smile. Before she let the pirates into the bridge of the Rook*, she explains, she had turned the key in the lock of the scuttling control box. The self-destruct charges are now armed, and she'd thrown away the key. The charges were designed to be highly sensitive once armed: if just one rocket is fired from the surrounding ships, the* Rook *will blow up, taking prisoners and pirates with it.*

"And if you hurt any of us now," she says as he furiously raises his sword, "you'll just be signaling our boys to fire."

A day later the Rook *is docked at the alien "tourist station" mounted in the outer skin of the world. Chaison Fanning negotiated a disengagement from the pirates, who have escaped. While their crew recovers and restocks at the*

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station, Chaison Fanning and Venera go to visit the station, taking Aubri Mahallan with them. They are here to recover an artifact given in trust to the aliens centuries ago—the map, in fact, that will lead them to the legendary treasure of Anetene. They recover the map without incident, and the expeditionary force embarks for the inner regions of Virga, an area known as the principalities of Candesce.

None of this matters to Hayden, who is just happy to be alive. He's also a bit uncomfortable because Martor has been bragging about their accomplishments during the battle, and Hayden's suddenly become something of a celebrity aboard the Rook.

While the other crew may have warmed to him, however, Venera's man Carrier is becoming openly hostile. He tells Hayden he doesn't trust him and will be watching him from now on. Hayden isn't afraid of Carrier, but he's beginning to realize that the man may be far more dangerous than he looks.

Hayden has other things to worry about anyway. Aubri has not been physically injured, and she insists on getting back to work building her strange devices—but she won't speak to him. When he confronts her about it, she tells him that it's because of the way he acted during the battle. She thinks he's a coward or, at least, not someone to be trusted.

The way to the treasure lies through the inner shell of nations that surround Candesce, the giant, self-maintaining artificial sun at the center of Virga. The expeditionary force is stopped at the dusky border of one such nation by powerful battle cruisers. Foreign warships are not accepted lightly into the ancient, decadent societies that bask in the undying light of the sun of suns. The ships are escorted—as "guests"—to the capital of the nation of Gehellen. The place seems strange and repellant to the people of the outer nations; there are few town wheels here. Most of the people appear to live in perpetual weightlessness and consequently have developed into impossibly delicate, spidery beings that scuttle along the ropes holding the thousands of buildings of the city together. Only the military, and the rich and powerful can afford gravity here.

While their petition to travel through the nation is considered, the captains and officers of the expeditionary force are invited to attend a ball hosted by the local Slipstream ambassador, Richard Reiss. Aubri begs off, claiming that she needs to visit the local library to research Anetene. As a foreigner from beyond Virga, hence something of a curiosity, she is allowed to wander as she pleases. Reluctantly, she employs Hayden to transport her in his sidecar.

At the library Aubri and Hayden learn that Anetene's treasure is hidden somewhere in a sargasso called Leaf's Choir. Sargassos are forests that have hyper-oxygenated their interiors and subsequently caught fire. Leaf's Choir was one of the largest forests in Virga; all that is left now, after the holocaust several centuries ago, is a sphere of charred wood and ash fifty miles across.

That black ball is now tethered at the edge of Gehellen's territory; they are slowly mining it for its charcoal and other resources, but it's slow work. There is no breathable air inside the sphere. But Aubri's map says that deep inside it somewhere is the hidden treasure of the pirate king.

Since they have been forced together and are away from the Rook, *Hayden and Aubri start talking again. He decides he can trust her, and tells her his story—the complete story this time, including why he came to work in the Fanning household. Aubri is appalled at his nihilism and tries to tell him that the world is a better place, that there's much to live for. But her own conviction seems weak, and at last she admits that she herself is in Virga against her will. She committed crimes against the sys-*

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tems of Artificial Nature, and in penance she has been sent into Virga on a mission whose details she is afraid—or ashamed—to reveal. This mission is separate from the one the Fannings are on, but is connected. She and they have one goal in common: to find a way into the protected, automated heart of Candesce.

As they are talking, Aubri realizes that someone is following them. It's one of the pirates who boarded the Rook, *and when he realizes they've spotted him, he calls for the police. A chase ensues—pirates and constables after Aubri and Hayden, who nevertheless succeed in getting back to Hayden's bike. Realizing that the pirates—who know about Anetene—have made some sort of deal with the Gebellen government to share Anetene's treasure, they burst in on Admiral and Lady Fanning's cocktail party, just as the Gebellen secret service are closing in on the Slipstream officers.*

The officers now find that they must fight their way back to their ships. Hayden takes up a sword along side Admiral Fanning and they make their way back to the Rook, *and cast off. Pursued by Gebellen's navy as well as the remnants of the pirate fleet, they strike out at a dangerous velocity through the crowded air of Gebellen. Great piloting skill is needed to get them to the black claw-like fronds of Leaf's Choir but once there, they plunge into the dead air without hesitation. The six ships of the expeditionary force were refitted as Winter ships—each has an internal oxygen supply, which should last several days.*

Using the map that Venera retrieved from the tourist station, they make their way through the nightmarish environment of the sargasso of Leaf's Choir. Nothing lives here except fungi and bacteria; the dead charred branches of the trees make an impenetrable veil over the light of Candesce. Here and there in the darkness they glimpse the ghostly outlines of former towns or farms, burned in place and now tombs for hundreds of thousands, maybe millions of people. It is dangerous to linger here; even someone who knew that the treasure trove lay within the sargasso could never find it unless they knew exactly where it was.

In the dark tension of the journey, Hayden and Aubri come together in her quarters. They make love; but though she obviously finds his presence healing, she will still not tell Hayden what her mission in Virga is. She only reveals that unless she fulfils her part of the bargain, she will be killed by the authorities that sent her here.

After two days inching through the black ruins, the lookout spots something gleaming in the Rook's *headlight. Nestled among the autumnal leaves of the sargasso's unburnt heart is their goal: the treasure of Anetene.*

And now the conclusion . . .

15

The ancient ship hung in the center of a cave of leaves six hundred feet in diameter. In the dancing light of lanterns waved by the gang of red-suited sargasso specialists, Venera could see occasional flashes of the ropes that suspended the old corsair like a fly in a spider's web.

"They're taking too long," she grated. "What's the hold-up?"

Her husband rested his hand lightly on her shoulder and peered out the porthole. "They're testing for booby-traps, dear. On my orders."

"And then we go over?"

"*I* go over. To find the box."

"*We* go. This expedition was my idea. The box was my discovery. You can't let me miss out on the final moment."

He sighed. "Have you ever worn a sargasso suit?"

"Have you?"

One of the little figures out there was waving its lantern in a strange pattern.

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The others were clustered around a dark opening in the side of the ship. The craft was smaller than the *Rook*, and unornamented; but the lines seemed archaic, even to Venera's untrained eye. "What's he doing?" She pointed.

"Signaling the all-clear. Apparently Anetene decided the sargasso was a big enough booby-trap all by itself." The little figures began disappearing one by one into the dark hatch. Little glints of light on the hull revealed portholes hidden in shadow around the curve of the ship.

"It'll be there," she said confidently. Either that, or she'd have to find a new home. Rush would no longer be a suitable dwelling once Falcon Formation took over.

Venera tried to pretend that this would be a mere matter of convenience. But she kept imagining herself returning to her father's court with her exiled husband. They would eat him alive, those back-biting courtiers, the kohl-painted ladies with their poisoned hairpins, the gimlet-eyed men with their ready poniards. Chaison would be used as sport by the jaded or the marginalized, and he would have no one to defend him.

It would surely be a personal humiliation for her, if he were killed.

"Well, if it's safe, let's go then," she said; but a commotion from the chart room distracted Chaison. Venera scowled at him as he turned away.

"It's Gridde!" Travis was waving frantically at the admiral. "He's collapsed."

Chaison dove for the doorway. "Was it bad air?"

"I don't think so. Exhaustion, more like."

Venera followed the whole bridge staff back to the map room. This was a tiresome interruption, but she had to be supportive of her husband. She affected a look of concern as she entered the room. The air in here was close, stinking, but then so was the rest of the ship by now. Gridde hung limply in midair, tendrils of white hair haloing his head.

"I got you there," he whispered as Chaison moved to hold him by the shoulders. The old man's face quirked into a half-smile, though his eyes were half-closed. "Rest now."

"Slipstream will survive, because of you," said Chaison.

Gridde's head rose and his eyes focused on the admiral. He managed a weak laugh. "Don't give me platitudes, boy. Just make sure those damn fools in the academy hear about this. I proved it." He began to gasp. "Old ways—better than—gel charts . . ."

"Get the surgeon!" cried Chaison, but it was too late. Gridde shook and sighed, and then went still.

Some of the bridge staff began to weep. Venera crossed her arms impatiently, but there was nothing she could do but wait. The brief agony of military grief would burn itself out in a few minutes and then everyone would get back to work.

They had come too far to let one more death stop them now.

Her breath and the suit pumps roared in Venera's ears. Every few minutes a loud bell sounded and she had to reach down to wind the clockwork mechanism that ran the pumps. She could barely see out the brass helmet's little window. The unfamiliar oilcloth sack of the suit felt like prison walls against her skin, its chafing creating a subliminal anxiety that fed back with weightlessness and the dark to make her jaw throb.

She didn't care. Venera was in a state of rapture, gazing into the most wondrous place she had ever seen.

The others' bull's-eye lanterns sent visible shafts of blue light up and down, flicking from side to side—each darting motion lifting a cascade of sparkling reflections and refractions from the contents of Anetene's treasure trove.

Venera had seen clouds rub past one another and throw up a cyclone; at either end these looked like tubes full of turbulent snatches of vapor. The interior of the

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treasure ship was like that—except that here, it wasn't clouds that formed the spiral down which she gazed. It was jewelry, gold coin, faience, and ivory figurines by the thousand.

The nets that had once held the treasure to the walls had decayed over the centuries, and so every week or two a gem or coin would disengage from its neighbors and drift into the ship's central space. Once there, it would be caught up in the almost imperceptible rotation in which everything inside Virga participated—something to do with orbits and tides, that was all she knew of that. But the vortex had grown and remained stable for centuries, the drift of its objects slower than a minute hand but inexorable. The spiral pattern, so delicate, was now being erased by the blundering passage of treasure seekers.

For the moment, though, garnets, emeralds, and rubies made in the fires of Candesce trailed in lines and arcs through the air. Here and there gleamed dry-amber from sargassos on the other side of the world; chains of diamond like runnels of light flashed in her lantern's beam. The currency of two dozen nations sat fixed in air as though in solid glass (the stamped profiles of pilots and kings layered into shadow like a history lesson) among clouds of platinum and buttons of silver. Beneath the ragged netting the hull was still plated with paintings, skyscapes half covering formal portraits whose eyes awoke like a sleeping ghost's when her light touched them. One painting, only one, had broken free, and so it was that at the center of the cyclone stood a tall stern man in dark dress, his black eyes those of a contemptuous father gazing accusingly at the looters. Only the gilt frame surrounding him spoiled the illusion of reality. There was a fresh bullet hole in his chest, put there by the first man of Slipstream to enter the ship.

They'd be joking about that startled shot for weeks, she was sure.

Chaison had swum indifferently through the shining constellations and disappeared into the ship's bridge. Venera followed, not without plucking a few choice items from the air on the way.

Chaison's hand-light floated free in the air, slowly turning to illuminate the fixtures of the old-style, cramped bridge. Venera kept expecting to see skeletons, but there was no evidence of violence here; apparently Anetene had been compulsively neat. In the center of the room was a chart pedestal, and clipped to the top of this was an ivory box, its sides inlaid with fantastical scenes out of mythology: men and women under gravity, riding beasts she remembered were called horses. Chaison's hand hovered over the lid of the box.

"Oh, just open it!" Of course he couldn't hear her; even to herself, Venera's voice sounded muffled in the suit. She bounced over to grab the box just as Chaison reached down and flipped back the lid. Both of their lanterns lit the contents through the blue air.

The object was simple, a white cylinder a little longer than her hand with a single black band around its center, and a loop for grasping at one end. It was made of some translucent crystal that made it gather the light mistily. Chaison hesitated again, then grasped the handle and pulled it out.

He leaned his helmet against hers. "The key to Candesce," she heard, the distorted words barely audible through the metal. "Just as the old books described."

"Let's hope it works," she said.

"Candesce still works. Why shouldn't this?" He put it back in the case and closed it. Then he hung there in the air for a while, head down, as if praying.

Puzzled, Venera touched her helmet to his again. "What's wrong?"

Did she imagine the sigh or was it real? "I'm just trying to figure out what to do next," he said. "The Gehellens will be circling Leaf's Choir waiting for us to come out. How are we going to get to Candesce?"

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"You're not one to live in the moment, are you?" she said. It was true she hadn't thought that far ahead, herself. Maybe she should have—for he was right, this was a problem.

A wide moat of empty air lay between the principalities of Candesce and the sun of suns itself. Venera knew they would have to cross two or three hundred miles of open space to reach the ancient sun. Candesce was so hot that no clouds could persist in this zone, and no living thing nor habitation within a hundred miles. As the battered ships of the expeditionary force crossed this span they would be easy targets for the Gehellen navy.

"If we send the others out as decoys again, and just take the *Rook* . . ."

His helmet grated against hers as he shook his head. "We'll be seen. Not even a bike could get to Candesce right now."

"We'll have to hide, then. Wait them out."

"But there's another problem," he said. "We're almost out of time."

"What?"

"That dreadnought . . . Based on the progress your photos showed, it'll be ready to fly by now. And in a few days the Slipstream fleet is going to be thoroughly entangled in the fight with Mavery. If Falcon Formation intends to invade Slipstream, they will be amassing their forces as we speak."

Venera scowled at the little box. Their original plan had been to visit Candesce during its night cycle and let Aubri Mahallan work the magic she swore she could perform with the sun of suns. Then they would take the most direct possible course at full speed to Falcon Formation, and the secret shipyard there. Mahallan claimed that she could set a timer on the mechanisms of Candesce that would trigger the correct action after a predetermined number of days and hours.

"Someone's going to have to stay behind," she said. "Wait until after our ships have left and the Gehellens have given chase. Then go into the sun."

"That's what I'm thinking," he said. "Mahallan, of course. And someone to keep her in line. Your man Carrier is the natural choice there."

"Me," she said quickly.

"No, dear, I absolutely—"

"Why? You think I'm going to be safer on board the *Rook* when you go into battle against Falcon? Besides, love, this is our plan, yours and mine. Who are we to trust to see it through, if not one another? When you go up against that dreadnought, you need to focus on the task at hand and not worry about whether Mahallan's done her job, or whether Lyle Carrier really is loyal. You need someone you can trust."

"And I can trust you."

"Why Chaison, that almost sounded like a question." She laughed and punched him in the arm. "It's the best plan, admit it."

He admitted it and they turned to go. As Chaison pulled the ivory box away from its moorings, something small tumbled out. He didn't notice. Venera waved her lamp around until the thing flashed; there it was, twirling away towards a forward porthole. She reached out and snatched it out of the air, then held it up between two fingers.

It was a ring, a signet made for a man's hand. The stone was opaque blood red and the design was of a horse standing on its back legs. The horse had wings.

She slipped the ring over the bulky glove of her suit and followed her husband out of the bridge.

Howls of childish delight echoed through the *Rook* as a spew of gold and jewelry flew from the wooden airlock door. Moments later a man in a red sargasso suit squeezed out waving his hands over his head. A muffled "unh, unh" sounded from inside his round brass helmet; but nobody was paying any attention to him. Crewmen and officers, the press-ganged and the volunteers, all abandoned civility and leaped on the rico-

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cheting treasure. The man in the suit finally levered off his helmet and yelled, "This is just the dregs, boys! There's tons of it there! Tons!"

A light hand descended on Hayden's shoulder. "Hey," said Aubri in his ear. Hayden felt himself flushing, and his heart beat a bit faster.

"Admiral wants to see you," she continued. Peering past him, she said, "They look happy, don't they?"

He had to laugh at the absurd understatement. The men were weeping, fighting over trinkets, screaming, and bouncing off the walls.

Then her previous words penetrated his consciousness. "Fanning wants to see me?"

"Yes, he's in the chart room." She gave him a little push in the lower back and he began to glide through the center of the rioting crewmen.

He bounced off several people and ducked around the worst of the fighting—just in time, as the airlock opened again and another bag of gold was dumped into the air.

The forward section of the ship was relatively empty by the time Hayden reached the chart room. He knocked and Fanning's muffled voice said, "Come in."

The presence of numerous lanterns did nothing to brighten the can-shaped chamber. To Hayden's surprise, Fanning was alone, hovering with one foot in a strap near the map table. In the dim light he was a study in muted shades, his eyes and the folds of his uniform blended into shadow. He had his arms crossed and seemed to have acquired new lines of care around his eyes and mouth.

Part of Hayden's mind said, *Now's the perfect time, kill him!* He did his best to ignore the small voice. "What can I do for you, Admiral?" he said.

"I hear that you have gotten to know our armorer very well," said Fanning, his face deadpan.

How did he know? Was news of Hayden's tryst with Aubri all over the ship already? "Well enough," said Hayden cautiously. What did this mean?

"Maybe. Maybe well enough, for the task I've got in mind." Fanning waved him inside. "Shut the door, if you will." Hayden could still faintly hear the sounds of revelry through the walls after he did so; he glided over to a strap near the admiral's and stuck his foot through it. The two men faced one another over the glowing map table.

"I'm about to let my wife out of my sight for an extended period of time," said Fanning with a cryptic smile. "Months, probably. Do you know the details of our plan? Why we're here?"

"No more than anybody else, sir."

"Hmm." Fanning stared off into the darkness for a moment. "What this is all about, Mr. Griffin, is about defeating a numerically superior foe. When Venera first came to me and told me how she'd put together a collection of old clues and documents, and now believed that radar might be possible in Virga, I wasn't much interested. It's a technology that would have only marginal utility in a fair fight—in daylight, in clear air, I mean. But the evidence that Falcon Formation was about to invade changed everything. With no guidance from the Pilot, we were about to commit a strategic blunder and lose our nation."

"I can't much care about that, sir. I was born in Aerie." It was a halfhearted challenge, but he felt he had to make it.

To his surprise the admiral merely nodded at the revelation. "That explains some things about you, though by no means all. You're a good airman, Hayden, but I've been wondering if I could trust you. We fought side by side on the way out of Gehellen, but you know that proves little."

It was Hayden's turn to look away. "I considered you my enemy for many years," he said.

Fanning smiled. "Well, I probably still am your enemy, politically. But I don't feel like you're a personal enemy of mine, Griffin. And that makes a world of difference in the current situation. Tell me:

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what do you suppose will happen to Aerie if Falcon Formation conquers Slipstream?"

"It'll be as if we never existed," he replied. Fanning caught his eye and Hayden shrugged. "I know that you're the only hope for my people right now."

"And what do you think of my wife?"

Surprised, Hayden said, "Well, I like her well enough, if that's what you mean."

Fanning sighed. "In order to carry out our plan, I have to leave her here while we make a run for the Gehellen border," he said. "She needs to sneak by the locals, get into the sun of suns and turn a switch that will make it possible for us to use those radar units that Aubri Mahallan has constructed. Actually, Venera's not the one who has to throw the switch; she doesn't have the technical expertise. Aubri Mahallan does."

Into the sun of suns? And Aubri too? Hayden's face must have betrayed his surprise, because Fanning smiled.

"You understand. I'm not at all comfortable leaving my wife here, Griffin, but it was always her plan and one of us has to supervise Mahallan. Am I right in assuming that you'd feel just as uncomfortable leaving Aubri behind?"

Hayden chewed his lip. He'd been caught totally off guard by the notion that the expedition would be headed for Candesce. Old emotions and new questions were starting to boil up in him. Focusing on the matter at hand, he said, "I'm not sure that Aubri's my woman. Or anybody's."

"But is that how you *feel?*"

"Look, what are you getting at?"

"I want you to fly them into Candesce, and then find a way back to Slipstream when you're done," said Fanning earnestly. "I don't have anybody else I can trust to do the job. In fact, logic tells me you're the very last person on this expedition that I should trust. But I think I'm right about you, so I'm asking you straight up: can I trust you to do it?"

"You're not going to damage Candesce, are you? That would be . . ."

"Insane. Suicidal. Genocidal." Fanning shook his head. "I don't think we *could* damage Candesce, even if we wanted to. No, our change will be small, temporary, and unnoticed by anyone in Virga. If you agree to go, you have a chance to guarantee that yourself."

Hayden couldn't believe what he was hearing. Fanning trusted him! Surely he didn't deserve that trust, not with all that he'd planned and tried to do. There was no way he should accept an offer such as this; he was bound to betray it, by honor and the momentum of his long-held purpose.

Yet, Aubri would be going. She might need his protection. It was with a sinking feeling of guilt that he said, "Yes, I'll do it.

"I'll take them in," he said, unsure of whether he believed himself, "and I won't interfere with your plans. As long as Candesce remains safe."

And then, to shame Hayden even further, Fanning smiled at him. "I know I can count on you to bring them home safely," he said.

Hayden smiled, and nodded, but did not believe it of himself.

The air in the ship was stagnant and heavy by the time the *Rook* made its rendezvous with the other vessels. All six met under the empty gaze of Carlinth's windows. Huge nets full of treasure were towed to the partially repaired *Tormentor* and its sisters while in the *Rook's* chart room Admiral Fanning read reports of the skirmish with the Gehellens. The dangerous diversionary tactic had worked well and nobody had been killed, although two more ships had suffered hull breaches and their crews were only now able to take off the oxygen masks they had worn while they repaired them. They didn't care; there was jubilation over the treasure and cheers echoed through the sunless streets of Carlinth for the first time in centuries.

While Admiral Fanning shouted an inspirational speech through a bullhorn

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mounted into the hull of the *Rook*, Hayden camped out in the hangar. With the help of Martor, he was modifying one of the military bikes. Fanning's words came muffled through the walls; nearly everyone else on all the ships had their ears to their hulls and was listening intently.

"*. . . Falcon Formation will destroy . . .*" Fanning was saying as Hayden held up an afterburner housing for Martor to see. "Designed for speed but built for reliability," said Hayden. "Typical military. These are tough bikes, but that extra armor and framing's gotta go."

"*. . . Only the most extraordinary measures can save . . .*"

Martor was wiring two extra saddles onto the bike. "But the armor's insulation, too, ain't it?" He tapped the outer shell of the cylinder. "I damn near burnt my foot off on your racer, and there was insulation on that."

"*. . . Up to us to do the job . . .*"

Hayden shrugged. "Saddle, footstraps and handlebars will be it. Touch the bike at any other point and it'll burn you. But it's the price we pay for decent speed with this baby."

"*. . . Not only rich, but heroes . . .*"

Hayden reached out to flip a gold chain that looped around Martor's neck. "What are you going to do now that you're rich?" In the absence of gravity, the trinkets hung off the boy every which way, making an absurd tangled cloud in front of his face that he wiped to the side every few moments.

"I dunno," he said. "I always been navy. . . . Buy a ship, I guess. Explore."

Hayden grinned. "Hunt pirates?" But Martor shook his head.

"I didn't like the fighting, come right down to it," he said seriously. "Some things are great to talk about, but awful to see or do." He looked away shyly, "But, you know . . . talking about it was great fun. The lads loved my stories and they were easy to think up. I was thinking, maybe when we get back, I might try learning to read and write."

"You, a story teller?" Hayden nearly laughed, but he could see that the boy meant it. "That's a great idea," he said. "You'd be good at it. Uh, hand me that wrench, will you?"

"Hi." Hayden looked up as Aubri entered the hangar. She wore practical leather flying gear including an airman's cap with goggles. She swam over to the bike and stopped herself with one hand on it and one on Martor's shoulder. "How are you?" she asked the boy. Martor stammered something incoherent.

"You need to stay out of trouble while we're gone," she told him. "No fighting and no profiteering, you hear? We're going to check up on you when we get back."

"Yeah, well." Martor shrugged. "First we all gotta survive the week."

"Ten days," she corrected. "That's how long it'll take for you to get to Falcon Formation, assuming you escape the Gehellen dragnet. And assuming you don't run into anything, and assuming that the navigation team can find your sun and you don't end up wandering around and around in Winter til the end of time." She grinned at Martor's expression. "Don't worry. We've got it timed down to the minute."

"That's what worries me," muttered Hayden. This was the weakest part of the plan: Fanning would have to get back to Falcon Formation in time to attack the secret shipyard at an exactly predetermined moment. With all the vagaries of travel in Virga—navigation errors, collisions, breakdowns, fuel shortages, and piracy—it would be a miracle if they could do that in time. By contrast, Hayden's own part in the plan was simple.

Just fly straight into the sun of suns.

"And what are you gonna do after?" Martor asked suddenly. Hayden looked over; he'd been focused on his work and didn't know who the boy had asked. He opened his mouth and saw Aubri doing the same. They looked at each other. Both hesitated.

Martor saw this exchange. "Oh," he said, drawing the sound out with obvious

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relish. "That's something you haven't talked about, is it?" He squinted at Aubri. "Are you going back to your weird world? Or are you gonna settle down here?"

"I don't know," she said. Unsatisfied, Martor turned to Hayden.

"Are you gonna stay with the *Rook?* The boys'd love to have you. Or are you gonna settle down in Rush? Get married, have lots of kids."

Hayden shrugged. "Haven't thought that far ahead." He avoided Aubri's gaze, though she also seemed to be looking elsewhere.

Hayden *had* thought that far ahead—and further. He hadn't discussed his thoughts with Aubri; he wasn't sure she would understand or agree.

He buried his head inside the bike, and didn't come out until the other two had changed the subject.

The night watch was well under way when Hayden came back to the hangar. The *Rook* and its sisters were creeping towards the outskirts of Leaf's Choir, much more cautiously than when they'd entered. The hatch gang had left the hangar, but the place resounded to the snores of the various *Unseen Hand* crew members who'd been billeted here. Hayden wove in and out of the men who hung like pupae from the walls, floor, and ceiling, until he came to his bike. Then he eased the folded cargo net and heavy coil of cable off his shoulder and parked it in midair next to him. Unfolding his tool kit, he selected a wrench; he dug in his pocket for a moment and brought out some brackets and bolts. Quietly, so as not to wake the men, he proceeded to bolt the brackets onto the back of the bike, over the afterburner.

Hayden had been taken aback by Admiral Fanning's request that he shepherd Venera and Aubri to Candesce—so taken aback that for almost an hour afterward, he hadn't realized what doing that could mean. When he did, it was in the midst of a conversation with the new boatswain; Hayden had lost his train of thought in mid-sentence, and just stared slack-jawed at the dark hull until the boatswain said, "What's up? You having a stroke or something?"

He'd stammered some sort of reply and extricated himself from the conversation. Going to a porthole, he stared out at the blank nothingness of the sargasso, as an unfamiliar sense of lightness crept over him.

Words whispered in his mind; was he thinking them, or were they a memory of long ago? It might have been his father's voice saying, "*Candesce is the mother of all suns. If Aerie is to have a new sun, its core will come from there.*"

No one had ever told Hayden how Candesce gave up its treasures; but he had heard that collecting them was easy. "Like picking fruit," one of the Resistance engineers had said.

Now as he worked as quietly as he could, he reflected upon the irony that Fanning himself would probably approve of what he was doing. If he got caught, he could in fact appeal to the admiral. Carrier was the one more likely to object, but Hayden wasn't afraid of Carrier. No, he was doing this in secret and on his own time not because he was afraid of being caught but because this particular task was his alone. It was personal.

He plucked out the stuffing of the bike's saddle and replaced it with the coiled cargo net. Little tufts of stuffing started floating away and he jammed them in his pockets. Then he reached around the bike's exhaust vent and began coiling the thin cable inside the bike's housing. He wired it in tightly and leaned back with a satisfied smile to admire his work.

Miles and his cronies in the resistance had been right about one thing: it wasn't what you fought that mattered; the only thing that mattered was what you built. Hayden's own parents had known that, but he'd forgotten it for years after their deaths. Wasted years?—No, they had brought him here, now, to finish some-

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thing that should have been done a long time ago.

He put away his tools, patted the bike, and headed for the ship's centrifuge to sleep under gravity for the last time in a long while.

16

Candesce blazed beneath Hayden's feet. Even here, hundreds of miles away, the heat from the sun of suns was almost intolerable. If he shielded his eyes and looked near the light, Hayden could just make out the bright tails of infalling lakes that were boiling away as they approached that point of incandescence. "They look like comets," Aubri had said when she first saw them.

Other things moved near Candesce. Ships from all the principalities hovered just outside its zone of heat, moving in after sunoff. Among the principalities of Candesce, it was common custom to consign the coffins of the dead to the sun of suns; Hayden imagined that they too must become comets at the last, never reaching their goal but evaporating back into the stuff of Virga to become places and people again. So must his mother have gone when Aerie's new sun exploded. His father would have become compost for some Slipstream farm.

Some of the ships hiding in Candesce's light would be funeral vessels. But some had another purpose.

"What are you doing?" Aubri looped an arm around his waist. "You'll burn your eyes out doing that. Come inside."

Hayden had been thinking about the ships that ventured close to Candesce during darkness. They were the harvesters—boats that scrounged the garbage cast out of the sun of suns. That garbage was Virga's chief source of sun components. His parents had used fusion-core pieces bought from the principalities to build Aerie's secret sun.

For now, Hayden would not let his speculations run away with him. He let Aubri draw him inside the charcoal harvester's hut they had found on the outskirts of Leaf's Choir. It perched like an angular bug on the black branch of a tree whose roots lay miles away in darkness. Venera Fanning and Carrier had taken up residence in another harvester's hut some distance away; the bike was hidden there in a ball of sticks. Carrier would not trust Hayden to be its keeper.

He didn't care. It had been strange and wonderful this morning to wake to the first glow of Candesce coming through the one shuttered window of the hut, and find himself wrapped in Aubri's arms and in silence. He had slept with women before; he had never awoken the next morning to find one still with him. So he dwelt in this moment for a long time, breathing slowly and contentedly with her beside him.

The now-familiar hum of the *Rook's* engines was gone, and not even birdsong signaled dawn here. When Hayden pulled himself over to the window (sleeping Aubri coming along like she was tied to him) he looked out on an astonishing vista. It was as if he were a mite clinging to a giant's hair; for miles in every direction thin black trunks reached towards Candesce from a place of shadow and blackness. The giant's hairs twisted and intertwined as they strained towards the light; many still had branches though the harvesters were systematically stripping them. None had leaves, but life was not completely absent here. Wildflowers nestled in the crooked elbows of branches, and bright green bushes dotted many trunks. Aubri had discovered wild raspberries on this very tree, which might explain why the hut had been positioned here. It was too hot for fish, but a few birds cruised in the distance.

After an hour or two Hayden had started to wonder if there might be a beehive or wasps' nest hidden somewhere nearby, because he'd realized that it wasn't completely silent here. A deep basso thrum filled the air, faint but unwavering. He hadn't heard it last night.

When he mentioned it to Aubri she

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just shrugged and said, "It's Candesce. Up close it must be like a god singing."

He was in awe of Aubri's knowledge and said so. "You truly know how to control Candesce? You could make it your toy, like a bike?"

She shook her head. "Ride it like a rocket, more like. But Hayden, Candesce was designed before Virga existed. Those designs are still available to anyone willing to leave Virga to find them. I had them with me when I first came here."

That conversation had happened a few hours ago, and had trailed off into kissing and more personal intimations. But her words had stuck with Hayden, growing stranger and stranger the more he thought about them. Now, as they settled in the cooler shadow of the hut, he said, "Why would you have the plans for Candesce with you? Did you already know you were going to visit it?"

She frowned, just slightly, and looked around at the wicker walls. But when she met his gaze again she wore a carefree smile.

"I came here with every piece of information we'd ever collected on Virga," she said. She held up two fingers and pinched them close together. "All that data could be contained in something much smaller than a grain of sand, so why not carry all of it? Of course, when I got here, the memory store was disabled by Candesce's emissions. So I'll have to go on what little I remember when we get there. But I remember enough."

He nodded, still thinking about it. Suddenly Aubri grabbed his arm. "Look!"

Buzzing in the doorway was one of those odd little chrome insects that one saw sometimes. *Tankers*, Aubri had called them. Hayden reached out a hand. "Should I catch it?"

She shook her head. "I don't have my instruments with me, I couldn't study it now." The little tanker spun around and zipped off. A sudden cloud of similar bugs flicked past the window.

"You were right," Hayden said. "They're headed for Candesce."

"Carrying fuel," she said with a nod. "For the Farnsworth Fusors."

They floated together inside the hut, exhausted after making love, and were silent together. He was acutely aware that much had gone unspoken between him and Aubri.

At last he turned and laid his hand, gently, on her breastbone. "Does it listen?" he asked her. He had no need to say what *it* was.

She shrugged. "I need to be careful. But . . . it doesn't care. Not really. It's just a dumb mechanism."

He thought about that. Then he nodded to the window. "Was this your mission? To visit Candesce?"

She looked him in the eye and said, "No. In fact . . . it's the opposite. If there's anywhere in Virga where I might find a way to free myself from this . . ." She tapped her throat: "Then it would be there."

Hayden shook his head in confusion. "You don't need to be careful about telling me that?"

"No. The assassin-bug only cares whether I tell people what my real mission is. It's not able to care about anything else."

"Not even its own life?"

"It's not alive. So, no." She quirked a smile. "Look at it this way: some things trigger it, some don't. That's all."

"So . . ." He mused. "You think we might find a way to kill it in Candesce?"

"It's why I pushed the Fannings to do this. A selfish reason, maybe." She shrugged, grinning. "But it worked."

He laughed. "Can I help?"

She kissed him. "Just keep guard. I'll do the rest."

"You can help me, too," he said seriously. Aubri cocked one eyebrow. "Both of us, really," he added. "Aubri . . . have you actually thought about what you'd do if you got free of that thing? Would you stay, or would you go?"

She hesitated. "Stay," she said finally. "I would stay."

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Hayden sighed. He took a moment to compose his thoughts. "I have a reason for going into Candesce too," he told her. He felt his heart lifting as he described his plan to locate sun components in Candesce and return them to Aerie. "I want to finish my parents' work. Light a new sun on the edge of Winter, that the people of Aerie can gather around. Let them leave Slipstream and the rest of Meridian behind. Save my people."

It would have sounded like an arrogant, impossible dream to Hayden—had not his mother and father confidently pursued that same dream.

"I'll need an engineer," he said. "You could be invaluable."

"Oh." She looked away. "Is that all you want me for? My engineering skills?"

"No!" He laughed and pulled her to him. "More. I want much more. We could found a new nation together, Aubri. Is that something you could want?"

She wrapped her arms around him and buried her face in his shoulder.

"More than anything," she murmured, "I would want that."

They both woke with a start. It was the middle of the night, and absolutely black inside the hut. Somewhere, far in the distance, something had screamed.

"Did you hear that?" Hayden asked. He felt rather than saw Aubri's nod. They both listened in perfect stillness for a while; then she relaxed against him.

"Maybe Venera's cohabitation with Carrier is not so chaste as we'd been led to think," she said.

"Ugh," he said. "Don't say that. I—" He stopped, as a long, ululating sound crept through the night to enwrap the hut.

They were both at the window a second later, peering out into the gloom. "That wasn't any person," said Aubri needlessly. There was nothing to see outside the hut, however—nothing at all, an extravagant blackness Hayden couldn't remember encountering even in Winter. For a moment he wondered if the hut had somehow slid backward into the depths of Leaf's Choir. How would they know, before they suffocated?

The cry came again, and this time it was accompanied by the sound of branches shattering. The roar built—it seemed that entire trees were being thrown aside by something huge that approached through the darkness. The hut began to shake.

Then as quickly as it began, the roaring ended.

They stayed at the window for a long time, but nothing further happened. After an hour or so, a bobbing flashlight-beam meandered up the trunk of the tree, and Carrier and Venera appeared. Both looked grim.

"Any ideas?" Carrier asked without preamble. Hayden shook his head.

"Maybe we should stick together tonight," he said. Then, with sudden urgency: "Where's the bike?"

Carrier waved a length of twine Hayden hadn't seen he was holding. It stretched off into the blackness. "I towed it over," he said. "Thought it best." Hayden nodded.

They all crowded into the little hut and sat there looking at one another for a while. "This is ridiculous," Venera said after the uncomfortable interlude had stretched on for fifteen minutes. "We have to do something. Talk, at least."

"I agree," said Aubri.

There was another long silence.

"Let's tell stories," said Venera brightly.

They all stared at her in the feeble glow of the flashlight. "Ghost stories," amended Venera; then she laughed. "Oh, come *on*. Can you think of a better time to do it?"

Everyone laughed; and a minute later, Hayden found himself relating the story of the black pirate suns, and of the strange monsters reputed to live in Winter.

After his turn Venera spoke; and somehow Hayden wasn't surprised when it turned out that she knew lots of such stories, and relished telling them.

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In one of Venera's stories, Candesce itself had gone roving one night; the sun had been hungry after shining for so many centuries, and it ate several of the neighboring principalities before being talked out of a further meal by a brash young farm boy. Venera tailored her description to the night's events: the unseen sun passing in majestic noise, a skyscape of sounds, no sign of what had caused its devastation after it returned to its station and lit again.

Aubri clapped her hands when the story ended. "You have hidden talents, Venera!"

The admiral's wife preened, examining her nails with ostentatious care. "I do, don't I?"

"I hope you don't mind my asking, but I've been wondering all along how you managed to convince Chaison to bring you on the expedition." Aubri looked genuinely puzzled. "During our planning sessions he seemed adamant about leaving you behind."

"Ah," said Venera with a smile, "but that was before I blackmailed him."

"Ah—what?" Aubri and Hayden both laughed nervously. Venera waved a hand dismissively.

"Back when he was a student, my Chaison wrote a few seditious pamphlets denouncing the Pilot. Nobody knows that, of course—no one who would talk about it." She eyed Carrier, whose face was as wooden as always. "I found about it from an old drinking companion of his, and I held it over his head to get him to take me along. That's all." She said this in a modest sort of way.

Hayden couldn't resist a grin. "Chaison Fanning . . . denounced the Pilot?"

Carrier, however, was glaring at Venera. "You never told me about this," he said.

She shrugged. "Why should I?" Venera looked at him archly. "In any case, it's your turn, Lyle. Don't you have any ghost stories to share?"

Carrier stammered something, then looked down. After a moment, he met Venera's eye and said, "Ghost stories are for kids. Things that really happened are far more harrowing than any story."

Some line had been crossed, Hayden thought, but Venera didn't seem to have noticed. She pouted at Carrier and said, "For instance?"

"For *instance*," he grated, "take the story of a man who discovers that his son doesn't have the stomach for the things that need to be done to protect his people. The boy joins the resistance of a conquered foe, and tries to convince his father to do it too."

Venera arched an eyebrow. "What's so horrible about that?"

Carrier took a deep breath. "The father plays along with it. In the end the resistance comes to trust the boy, and of course he trusts his father—enough that one day he tells him the location of the new sun his friends are building. And the father," he said with a grim smile. "He does what any *loyal* man would do. He tells the Pilot."

Belatedly, Venera was realizing how angry Carrier was. "Youthful zeal," she said. "They grow out of it."

"Only if they live," said Carrier. "Only if they live."

Aubri shifted, half reaching out to Carrier. "What happened to your son?" she asked quietly.

"He died when the Aerie bastards blew up their new sun," said Carrier; his voice carried no emotion, no inflection at all. "But you know what? If I had to do it all again, I would. Because a loyal citizen of Slipstream will do nothing against the Pilot; will do anything for his nation." Again, he was watching Venera as he said this.

The silence that followed was long and awkward. Aubri tried to salvage the mood by telling a humorous anecdote about her brief days in Rush, but her delivery was wooden and it fell flat.

The damage had been done; all they could do now was sit in silence and wait for dawn. This was just fine as far as Hayden was concerned; he didn't want to

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talk any more. He just sat in the corner, nursing his shock.

The man he had sworn to kill sat next to him. For the moment, nothing else mattered.

But then a curious thing happened. As the hours dragged on, Hayden's anger lessened. When Candesce finally ignited in a stuttering dawn Hayden even allowed himself to exchange a wondering glance with Carrier as they gazed out at a vast gash that had opened up in the miles-long trunks of the dead forest.

"It's like some monster was *grazing* on the trees," said Aubri.

"Capitol bug?" asked Carrier, but clearly he didn't believe it. Capitol bugs were big, the way clouds were big, but they were not strong. Whatever had done this could eat whole cities.

"Candesce, walking," said Venera smugly. They all laughed, and the tension of the night broke.

Later, he watched Carrier and Venera fly back to their hut. Hayden felt curiously light, as if some huge responsibility had been lifted from his shoulders. Lyle Carrier was just a man, after all, and a sad one at that.

What had drained his anger? He wondered about that for a while, seeing Aubri, and Candesce burning at the center of the sky, there was really no doubt. Somehow in the past weeks Hayden had learned to look past yesterday and today. It was the possibility of a future that had changed him.

Maybe he could fulfill his promise to Chaison Fanning after all.

A swarm of bikes spiraled through Winter. Each flyer had a large magnesium lamp mounted in front of his saddle and great spears of light pierced the gloom as they searched for safe passage. Behind them, recklessly fast, came the expeditionary force itself. Dew beaded on the sleek hulls of the ships and tumbled away in their wakes. Their contrails could have been followed by anyone who cared to pursue them; but the Gehellen navy had given up at the border. The chase had been halfhearted anyway, since the Slipstream ships had gone many miles under cover of night before they were spotted.

Giant multi-limbed clouds reared out of the black, too big to circumnavigate. The bikers' flight leader leaned down to let off a sounding rocket and watched as its yellow eye receded into the mist. If it hit anything it would explode in a shower of phosphorous. He watched the contours of the cloud intently, heedless of the icy air tumbling past his limbs. After a moment he waved an all-clear and underscored the rocket's contrail with his own.

Some miles behind the bikes, Chaison Fanning climbed out a side hatch of the *Rook* and hooked his feet through a ring on the hull. He stared out across a hundred miles of cloud-dotted air at the hint of silver in the darkness that identified Mavery's sun. Faint flickers and flashes lit the sky far up and to one side of that silver area.

It could just be a lightning storm—but the colors were wrong. Some of those pinpricks were red, some vivid orange. The light came from the border between Mavery and Winter. It was too far away for Chaison to hear the explosions, of course—but the battle must be huge, and fierce. He should be there.

After a while Travis clambered through the hatch with a blanket fluttering in his good hand. "Begging your pardon, Admiral sir, but you'll freeze out here," he shouted as he tried to drape the blanket one-handed over Chaison's shoulders.

"Look at it," said Chaison. The tiny stars that signaled explosions had only been able to keep his attention for so long, despite what imagination and reason had told him must be happening there. His gaze had inevitably drifted forward and eventually he'd realized that framed by the cross-hatch lines of bike contrails was the collected light of nations. Half the sky was awash with luminescence in circles too broad to encom-

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pass with out-thrown arms. Their outer edges faded to dusk and black, their centers shone sky-blue and here and there a sun appeared for seconds at a time. There were a dozen such realms of light in the cluster of nations known as Meridian, but the farthest countries were hidden behind the nearer.

The pearlescent zone of sky next to Mavery was Slipstream—had been Aerie, once. Obscured behind the *Rook's* hull was multi-sunned Falcon Formation. Chaison had climbed around the hull several times to look at it.

"The men want to go," said Travis, nodding at the sparkling battle. "They know we have another destination, but they're not happy."

Chaison sighed. "I'm not happy either. The fleet will be cursing my name that I'm not there. All of us—we've probably been branded traitors by now. If we don't bring back the figureheads of Falcon's flagship, the Pilot will have me publicly flogged. At the very least."

He made sure his feet were anchored, then stood up into the *Rook's* headwind. "That's where we go," he yelled, pointing to the vast span of light that was Falcon Formation. "And chances are we'll never see the light of Slipstream again. So enjoy the view while you can, Travis!"

"Come inside, sir!"

He shook his head. "When I'm good and ready. Leave me alone."

Travis retreated, a concerned frown on his face.

Chaison Fanning stood alone on the hull of his ship, feeling alone. Venera wasn't with him, and he didn't know how he felt about that. Did he even miss her? She was a constant presence, but he didn't understand her; and love was probably not the right name for what passed between them.

He didn't think she understood him either; but she thought she did.

Maybe, if they both lived through this, there would be time to get to know one another properly. He smiled, as the wind tore salty droplets from his eyes and cast them into the vortex of the *Rook's* contrail.

Candesce was fading like an ember when the four travelers climbed into their saddles and Hayden lit the fanjet's burners. Back became down, and they shot away from the threadlike trees of Leaf's Choir, seemingly straight up toward the sun. Hayden turned for a last look at the harvester's hut, and smiled. Then he adjusted the goggles on his nose, and opened the throttle.

They weren't leaving a contrail, he'd noticed. That was probably due to the heat of the air near the sun of suns; whatever the reason, they would be less noticeable to the Gehellen cruisers that still patrolled the air here.

—Or so he was able to tell himself for the first ten minutes of the flight; then he saw Carrier's hand waving from the opposite side of the bike.

Hayden craned his neck around the metal cylinder and at first saw only the normal traffic of funeral ships and scroungers cautiously edging towards the sun. After a moment he saw what Carrier had spotted: eight sparks of light rising over the black furze of the sargasso. They were the color of the sun, their backdrop the mauve air of dusk.

Carrier leaned past Venera to shout, "Bigger than bikes!" But smaller than commercial vessels; Hayden nodded. These looked like catamarans—twin engined, with both pilot and gunner. They'd be fast, and they could reduce the bike and its riders to splinters in seconds if they got close enough.

Hayden tapped the throttle, feeling for the bike's response. Then he leaned in as close to the hot metal as he dared and kicked in the afterburner. The women on either side of him pressed their noses to the hull as well while the air began to thunder past and Candesce seemed to get perceptibly brighter.

For a few minutes, that is; then the sun of suns began to go out.

It didn't do so all at once. In fact, as

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Hayden squinted past the handlebars he began to make out structure to the radiance ahead. Candesce, he realized with a start, wasn't one sun but rather a cloud of them. He tried to count them, but they were guttering faster than he could keep up. Each one left a fading red spot and, in the eye, a lozenge of retinal overload.

But the heat remained. He could feel it first in the places where the wind didn't penetrate: in the hollow of this throat; along his calfs. As the minutes passed heat piled up against the bike as if they were pressing into a resilient surface made of exhaust and fire. They crossed fifty miles of air and were swaddled in it; a hundred miles and it was becoming hard to breathe. The commercial ships had fallen behind but the catamarans still followed, their gem-like highlights wavering in the rippling air.

Little flashes started to appear in the corner of Hayden's eye. He was alarmed—was he about to pass out?—and then saw the contrails that were sketching across the sky like meridian lines.

Venera waved frantically. When he caught her eye she held up her hand in a gun-shape. He nodded and began slaloming the bike from side to side, gently at first so as not to shake off his passengers—then more and more violently as bullets stitched the air to all sides.

After a minute the gunfire stopped. He glanced back to see their pursuers close, but keeping a decent distance.

Hayden smiled. There was nowhere for him to go—or so those men thought. They believed that if they hung on his tail long enough he would have to give up. After all, there was no place to hide here, and no way to get inside Candesce.

They were in for a surprise.

A long wing of shadow swept into Winter behind Sargasso 44. The gnarled black fist of burnt forest, its outlines softened by mist, wasn't much to look at after Leaf's Choir, but it was still a respectable three miles across. The *Rook* and its sisters crept up to the hidden shipyard from its unlit side, their running lights off. Two bikes jetted out of Chaison Fanning's modest flagship to reconnoiter and he waited, not on the bridge but in the hangar, for their return.

Propriety be damned. He glanced at the ticking wall clock, then at his men. Two hours until Falcon's suns dimmed into their night cycle. In two hours the plan would succeed or fail. And everybody knew it, but nobody would speak of it.

They'd installed the radar casting machines in the nose of each ship and tried them. Of course they didn't work—there was only a bright fuzz on the hand-blown cathode ray tubes bolted next to the *Rook's* pilot station. But as each sister ship turned its own radar on or off, the fuzz had brightened or dimmed. Some sort of invisible energy was in play here. Chaison had been cheered by that tiny hint of future success.

And the men . . . He looked at them again. They'd been running drills for days now to perfect the art of firing blind according to orders from the bridge. The rocketeers looked confident.

He shook his head and laughed. "Lads, I don't mean to be insulting, but you look like pirates." Some were wounded, others had hasty repairs to their uniforms to cover sword—and bullet—holes. It was the jewelry, though, that set them apart from any other crew Chaison had worked with. As battle approached the men had been sneaking off to their lockers to collect their treasures, as if the talismanic weight of future wealth would keep them alive through the coming battle.

It was so far from regulation that he could validly have any one of them whipped for it. Necklaces might get in the eye, or tangle a hand at a crucial moment.

Nobody was going to be disciplined, and they all knew it. Perversely, knowing they knew it pleased Chaison. He felt an

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affection for this crew he hadn't known for any other he'd worked with.

The bikes' contrails hit the side of the sargasso and vanished. Forty-four was too small and old to have retained a toxic interior, especially with transport ships coming and going and all the industry happening inside it. Chaison had nonetheless insisted that the men on the bikes wear sargasso suits. It would a fine irony if they were knocked out by fumes and sailed their bikes right into the shipyard.

"Now we wait," said Travis. Chaison shot him an amused look.

"We've been reduced to clichés, have we?" he said.

Travis stammered something but Chaison waved a hand in dismissal. "Don't mind me," he said. "I'm feeling free for the first time in weeks."

"Yes, sir." Then Travis pointed. "Sir? Look."

The bikes were returning already. Falcon's shipyard must lie closer to the sargasso's surface than he'd thought.

"All right." Chaison clapped his hands briskly. "Let's see where we stand."

Hayden had seen clouds bigger than these rising spires, but nothing else—not even the icebergs at Virga's skin—could compare. On the outskirts of Candesce long arcing stanchions connected many glittering transparent spines, which soared into the surrounding air like the threads of the jellyfish that hid in Winter clouds. These spines were miles long but they were not anchored to a single solid mass. Candesce, he was surprised to see, was not a thing, but a *region*. Hundreds of objects of all shapes and sizes gleamed within the sphere of air sketched by the giant spires. Candesce was an engine open to the outside world.

So what was Venera's key intended to unlock? They glided in between the outreaching arms at a sedate pace. The enemy catamarans were hanging back, confident in being able to catch the bike and curious to see what Hayden would do. The moment was strangely peaceful, or would have been if not for the savage heat that radiated from those needles of crystal.

"Are they glass?" he wondered aloud. Beside him, Aubri shook her head.

"Diamond," she said. "Re-radiators."

As they passed the spires dim orange glows from the dormant suns revealed traceries of intricate detail further in: ribs and arching threads of cable, mirrored orbs the size of towns, and long meandering catwalk cages. With all the suns lit, internal reflection and refraction must double and redouble until it was impossible to separate real from mirage. Drowned in light, Candesce would disappear as a physical object. These spars and wires were like the crude ghost of something else that had no form. That something had left, for now—perhaps stalking the distant air to devour a principality or two. But it would return to its den come morning, and then this diamond and iron would give over to a greater reality, one made of light. Any person foolish enough to be here would disappear as well.

Venera and Carrier had raised their heads to stare as well. Hayden breathed in little sips; the heat was making him dizzy. "Where?" he asked Aubri with renewed urgency.

She scanned the unlikely bauble of the sun of suns. "There." Where she pointed, a dark rectangle lay silhouetted by one of the suns. It was nestled against the diamond point at the base of one of the spines. "That should—should be the visitors' center."

Hayden barked a laugh and instantly regretted it as the air seared his throat. "Another tourist station?" But Aubri shook her head.

"This one—" she gasped spasmodically, "is for education and maintenance. No remote control. No tourists."

"Nobody waiting for us, I hope."

She shook her head. Hayden fired up the bike and they shot through the glittering clouds of machine and cable. Now,

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though, he heard the sound of other engines. The Gehellen catamarans were closing in.

He guided them down the curve of the spire, alert for anything familiar. The rectangle ahead slowly resolved into a boxy structure about thirty meters on a side, made of some white substance. The crystal spike pierced its side, and next to that spot was a small square on the box. Hayden blinked in the wavering air; was it real? Yes, it was there: a door.

Sleek blue spindles eased into sight on either side of the bike: the catamarans. They were like streamlined rockets with outrider jet engines and a cockpit on either side. Both cockpits had heavy machine guns mounted next to them; two of these now swiveled to aim at Hayden's bike. One of the Gehellens gestured for him to turn around.

He waved *yes*, and kept going.

The square door was only yards away when one of the Gehellens fired a warning shot. The bullet *pinged* off the diamond wall. Hayden took his hands off the bike's handles and raised them surrender, while at the same time gripping the bike with his knees to steer it.

Another warning shot and this time Hayden looked down to see a puncture in the bike's cowling, inches from Aubri's face.

He reached to cut out the bike's engine and saw Carrier lean casually around the bike. There was a *bang!* loud in the sudden absence of engine noise and then Carrier was off the bike and spinning in mid-air and fired again.

Both machine gunners were dead, with identical holes in the center of their forehead. Carrier was yanking Venera off her saddle; he aimed her at the black outline of the door and pushed himself the other way into open air. Hayden yelled a warning and saw that Aubri was drifting off her own saddle, unconscious. Quickly he took one foot out of its stirrup and lunged for Carrier. They locked hands and he pulled the larger man back just as both catamarans rolled over—trailing spirals of blood—to expose their pilots, and the pilots' machine guns.

Venera had found an indentation in the wall and jammed in the white cylinder she'd been guarding. Both catamaran pilots opened up and bullets flew—sloppily as the recoil moved the gun platforms. A bullet hit Carrier's pistol and it shattered in his hand. He drew back, cursing.

Hayden grabbed Aubri's shirt with one hand and with the other, the bright edge of a suddenly opening door in the diamond wall. He hauled Aubri and the bike into dazzling light to the ear-shattering accompaniment of machine gun fire.

The sound cut off abruptly as the door shut and four humans and a bike tumbled onward into light.

"Nothing? Nothing at all?" Chaison felt sick. The two bike pilots weren't looking much better; the crew had formed a half dome around them, and were looking stricken as well.

"It's abandoned, sir. Shut down, except for one or two huts that look like security buildings. All the ships are gone—except the tugs, but . . ."

"They weren't just out of sight, hidden somewhere else in the sargasso?"

The two men looked at one another. They made identical shrugs. "Nowhere to put them, sir. We looked. Sir . . . sir, they're gone."

Gone. A Falcon Formation dreadnaught and a fleet of new warships were on their way to Slipstream. Maybe they were there already. And Chaison Fanning had taken seven ships that might have helped defend his home, and frittered them away in a useless quest for an advantage that had now proven chimerical. He had lost.

"Sir? What do we do now?"

Chaison Fanning had no answer.

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Cool air washed over Hayden's face. For a second he reveled in that, drawing in deep breaths and running his hands over his sweat-stained scalp. Then he

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turned to Aubri.

"She's not been shot." Carrier was already there, turning her over in midair like something he was inspecting at market. He was right, there was no blood.

Was it the assassin-bug she carried inside her? Had Aubri crossed some invisible line, or begun to say something that had triggered it? For a moment Hayden was sure that such a thing had happened, and that she was dead.

Then Carrier put his hand on her forehead. "Hot. Her pulse is a bit fast. She's not sweating; looks like she fainted from the heat."

Aubri coughed weakly and opened her eyes. "Oh, my head," she murmured. She looked around herself in confusion. "How did we get back to—oh." She pawed at the air, seeking something to hold onto. Hayden put out his hand and she took it, oriented herself upright with respect to the two men. "We're in Candesce."

"And we have a schedule to keep." Venera was waiting impatiently at a nearby doorway. The military bike hung in the air next to her, popping and pinging as it cooled. Hayden counted bullet holes as he pulled Aubri past it; there were at least twenty. A glance told him that the fuel tanks hadn't been punctured, but he wasn't sure about the burners or fan.

"Come on," said Venera. "Mahallan, are you awake enough to do your job?"

"Yes yes," said Aubri peevishly. But Carrier shook his head.

"She needs water and cold compresses," he said. "We don't want her making mistakes at a crucial moment."

Venera drew an ornate watch out of her silk tunic. "We have an hour," she said. "And I'm grudging you that."

They went to explore. It was easy for Hayden to tow Aubri, who seemed feverish and vague; if they'd been under gravity she might not have been able to walk.

"Familiar enough design," Venera said as they moved down a bright, white-walled corridor. The interior of what Aubri had called the visitors' center was divided into numerous chambers and corridors, but only in a loose sort of way by walls and floors that generally did not quite meet. Instead of the enclosed boxes one found under gravity, here were rectangles of pastel-colored material that were suspended in mid-air to suggest rooms and floors without limiting mobility. In many places you could slip over or under a "wall" into the next room, or glide through a gap in the floor into a room "below." Electric lights in many colors floated here and there, casting shadows that softened the edges of the space. This sort of plan was common in freefall houses and public institutions—but in those places you could always see the ropes or wires that kept the rectangles in place. Hayden could see no means of support for this place's walls.

The rooms were in turn subdivided by screens into different functional areas: eating and cooking alcoves, entertainment centers, even shadowed nooks for sleeping. It didn't take them long to find fresh cold water for Aubri. She splashed it over herself and began to look more alert.

"This place could house hundreds," said Carrier. "Are you sure no one ever comes here? It all looks a bit too well kept."

Aubri laughed. "After maintaining the suns of Candesce, taking care of this place must be light work."

"But light work for whom?"

"For what, you mean. Nothing we're likely to meet while we're here, Carrier. Nothing human."

He looked uneasy. "It's too empty in here. I don't like it."

Hayden searched the cupboards for something to help Aubri. To his surprise he found them well stocked, but the packages and boxes were lettered in an unfamiliar language.

Aubri was shrugging off any more help anyway. "I'm feeling better, Venera. Let's do what we came to do." She glided out of the kitchen alcove and slid through the loop of a large couch sling in the liv-

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ing area next door.

Venera frowned at Aubri. "Well then, what are you waiting for? Where's the . . . bridge, command center, or what have you?"

Aubri gestured at a blank picture frame that took up much of the ceiling. "It's where ever you want it to be, Venera. Watch." She spoke several words in a language Hayden had never heard before, and the picture frame swirled with sudden inner light. Then it seemed to open like a door or window, and Hayden found himself staring into the gleaming interior of Candesce.

Lit by some magical un-light, Candesce's interior teemed with motion like the little creatures Hayden had seen once when he looked through a teacher's microscope. The suns themselves resembled diatoms, spiky and iridescent; though they were quiescent, all around them things like metal flowers were opening. Their petals fanned like the hands of mannered dancers, hundreds of feet wide, to reveal complex buds of machinery that must have hibernated in tungsten cocoons during the day's heat. Bright things poured out of them like seeds from a pod—or bikes from a hangar.

Other things were moving too—long spindly gantries delicately picked crystalline cylinders out of the air and stuck them together end to end. Hayden glimpsed more machinery inside the cylinders.

"What are they doing?" he asked.

"Repairing," said Aubri in a distracted tone. "Rebuilding. Don't look at anything too closely, you could break it."

Hayden sent her a worried glance; he noticed Carrier squinting at her as well. But she looked more alert and lucid than she had a few minutes ago. Hayden decided to let her strange comment go.

He did want to examine this display of unfurling non-life. Hayden was looking for something, and after a few minutes he spotted it. One of the salvage ships from the principalities was nosing cautiously into the zone of mechanical activity. It flew a flag he'd never seen before, but he ignored that and its strange lines, and watched where it was going.

"Well?" Venera was asking impatiently. "Where are the controls, Mahallan? Hadn't you better get started?"

"Shush, Venera," said Aubri. "I've already started."

Hayden had heard that all the suns in Virga made use of discarded components of Candesce. He wasn't sure what he was expecting to see, but was still surprised when the principality ship swung in close to one of the big translucent cylinders as it was being hoisted near a sun. Some complex exchange had just taken place between the cylinder and one of the flowers; a door had opened in the crystal and swarms of metal insects swirled between it and the "flower." Now another hatch opened in the tessellated side of the sun, and another exchange began.

As it did, the hangar doors of the principality ship flew open and men in sargasso suits—star shapes at this distance—flung themselves into the stream of packages. They wrestled something away from its insectile courier; he could have sworn he'd seen the arcs and bands of that device before, in the half-constructed heart of his parents' new sun.

But wouldn't the metal bugs object? It seemed suicidal folly to try to steal from them. He waited for the swarm to turn and attack the men. After a long moment it began to happen: the remaining drones let go of their cargoes and turned towards the humans, who seemed oblivious to the threat.

Get away, get away, he willed them, even as the steel insects opened their claws and flung themselves at the men.

"Hayden, whatever you're doing, stop it," said Aubri. She was waving her hand in front of his eyes.

"Huh? I'm not doing—look at the ship, there!" He pointed.

Aubri turned and looked toward the principality ship. "Oh. You didn't, did

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you?" She sounded disappointed. "Let's stop that."

At the last second, the metal insects veered away from the men. "Hayden, stop it," said Aubri. "Look away, Hayden." She grabbed his shoulder and spun him around.

"What are you—"

"Hayden, we're looking into a wish-mirror. Don't you know what that is?" Aubri saw the blank looks on three faces and sighed. "No, you don't. Sorry. Listen, the wish-mirrors are the control system for Candesce. Whatever you look at in the mirror, that thing will do what you imagine it doing—insofar as it's capable of it and only inside Candesce. Hayden, you disrupted the movement of those cargo handlers by worrying whether they would stop what they were doing."

Venera laughed. "You made the bugs attack those men! You're meaner than I thought."

"Hey, I didn't mean to—"

"Wish-mirrors are sensitive," said Aubri. "Maybe it would be better if none of you looked into it for a while. I have to figure out which component of Candesce to switch off. It could take me a few minutes."

The three natives of Virga left the couch and returned to the food-preparation area. "How are we going to know if she's done the job or not?" whispered Carrier. Venera rolled her eyes.

"It's pretty late for you to worry about that. Chaison and I talked about it months ago. Mahallan's not the only person who knows something of old technologies; we had a professor at the university build *this*." She reached into her tunic and brought out a simple metal tube. It had a switch on its side and a single glass eye, like a bull's-eye lantern. "When I throw this switch, nothing happens. If Mahallan does her job, I'm told that a light will go on inside the tube when you switch it." She flipped the switch. Nothing happened.

"Does she know about this thing?" asked Carrier. Venera snorted derisively.

"No. Why would I tell her?" Idly, she turned the switch again. This time, the glass eye immediately glowed red. Venera yelped in surprise and let go of the rod, which tumbled slowly in the air between them. "Well," she said. "Well, well, well."

Hayden watched as the two of them hovered over the tube, talking excitedly. Venera's little indicator didn't impress him; he was thinking about his experience with the wish-mirror. The glass panels were scattered throughout this building; he tried to remember the words Aubri had used to light hers.

"Listen," he said, "the bike is full of bullet holes. If something's broken we need to know now, while there's still time to fix it. I'm not sure this place is going to still be safe for us once the suns start coming back on." Mother and Father had talked a lot of about radiation; he remembered that. Even if it remained cool in here throughout the day, it might be lethally radioactive while the suns were operating.

Carrier was nodding. "Go check it out, then."

Hayden took one more look at Aubri. She was perched in mid-air, staring at the glowing images on the screen. Her face was masklike, expressionless.

Heart pounding, Hayden slipped under a wall and away from the plots of Slipstream.

"When you're out of ideas, just give another order." Chaison Fanning recalled the cynical advice of one of his Academy teachers as the helmsman moved to execute his latest command. The expeditionary force was sweeping the air around Sargasso 44 using sophisticated spiral search patterns. He had all the bikes out hunting for contrails. It was all he knew to do. Meanwhile he retained a mask of professional calm, as though he'd expected this and had a plan. He had no plan. There was nothing left but to run for home.

"Bike brigade sixteen reports no sight-

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ings, sir," reported the semaphore team. Chaison nodded. There was nothing but grey mist outside the forward portholes. The clouds on the edge of Winter were to have been his greatest advantage if he'd succeeded in luring the Falcon Formation ships out of their den. Ironically, that dense pack of wraith-like mists was now obscuring any chance he had of finding where the enemy had gone.

The light outside the portholes was fading: night was coming to Falcon. The Formation synchronized its day and night cycle with Candesce, so the sun of suns must be going out now too. If Aubri Mahallan had done her job, in a few minutes the subtle distortions of space-time ringing out from Candesce would cease. This night, technologies long banned in Virga would become possible here again. Radar might now work.

The radar man Mahallan had trained was looking at him expectantly. Chaison gave a half smile. Why not? "Begin radar sweep," he said, chin on his fist. It was nice to know that his voice was still calm, despite his desperate disappointment.

Even now the newly minted Falcon dreadnaught might be bearing down on Rush. There was nothing in Slipstream that could stop it. The Pilot richly deserved to be deposed—Chaison knew he would get no argument from his men on that score—but Falcon Formation would eat everything if it conquered Slipstream. They had done it before: art would be repainted according to the arbitrary standards of the bureaucracy, literature rewritten to match the ideology of the Collective. Architecture would be chipped away and eventually, even the language itself distorted to match Falcon's vision of a perfect world.

A horrible sick feeling filled Chaison. He wondered if the citizens of Aerie had felt that way when the Pilot had uttered his ultimatum to them.

A younger Chaison Fanning would never have considered such a thing.

"It's working!" He shot the radar man an annoyed look. "Sorry sir. I mean, we have a signal. The screen is clear! Look."

Despite himself Chaison was intrigued. Aubri Mahallan had made toy versions of the system that showed how things were supposed to look. Now as he unstrapped himself and glided over he saw little glowing smudges on the two green circles of the display, very similar to the ones Mahallan had displayed. She had drilled the bridge staff in the meanings of the various shapes, and so Chaison had no difficulty in recognizing the other ships of the expeditionary force as spindle-shaped lozenges of lighter green. The two screens showed the results from rotating beams that were at right angles to one another. Comparing them, you could roughly guess at the position of objects in three-dimensional space.

The bridge staff was all staring over his shoulder. Chaison ignored them. "What's that?" he asked, pointing at a broad smudge well behind the centerpoint that represented the *Rook*.

"I believe that's the sargasso, sir."

"Hmm." He stared at the display for a few seconds. "All right then," he said, "if these shapes are us," he pointed, "and that shape is the sargasso," he pointed again, "then what, exactly, is *that?*"

Right at the edge of the displays, a collection of tiny dots scintillated. One by one they were leaving the screen, which suggested they were moving very quickly.

Chaison and the radar man looked at one another. Then the admiral jumped back to his seat. "All hands! Prepare for maximum acceleration! Recall all bikes! Semaphore team, order all ships to activate their radar! Tell them, if you want to have a place to spend that treasure you're wearing, then follow us now!"

After checking out the bike and spending an hour or so repairing it, Hayden drifted back into the corridors of the station. He dithered over whether to check in on her—but she had insisted that only she could find a way to excise the dark thing coiled in her throat. He didn't want

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to interrupt her in that crucial task. No, he had his own responsibility, and he had best fulfill it.

He found a small room far from the place where Aubri was working. It was dark here, but there was a wish-mirror on the wall. He strapped himself opposite and tried to remember the words Aubri had spoken to activate hers.

It took several tries, but soon the rectangle began to glow. "Huh." Hayden couldn't believe he was actually here, *in* Candesce, doing something no one had ever told him was even possible. Controlling the sun of suns itself.

The twisting ballet of Candesce's night machines revealed itself to him and he scanned the air for the things he sought. It seemed like many years since he had played in the half-built sun while his mother ordered construction crews about. Not that long a time, in adult terms. He remembered the day the precious inner components had arrived, shipped at horrendous expense and in secret from the principalities of Candesce. The crates with their exotic stamps and lettering were more interesting to Hayden than their contents, but he remembered those as well. Now, he examined the interior of Candesce looking for similar mechanisms.

From what he'd seen earlier, Hayden had surmised that the crystalline cylinders were factories of a sort, manufacturing new pieces for the suns. Now as he examined them—the display zooming in to fine focus if he wished it to, zooming out again just as easily—he began to understand the logic of the sun of suns. Those tiny glittering clouds spiraling into the cylinders, they were the bugs Aubri had called tankers, only here they swarmed by the million. They were bringing in supplies. Inside the cylinders and unfolded metal flowers, the metal foremen and laborers of Candesce forged new wicks for the sun, and when they were done they handed them off to other machines that installed them.

All that Hayden had to do was locate the pieces he wanted and then imagine them being brought here. *Park them outside the door*, he commanded. With mounting excitement he watched as his orders were obeyed.

No wonder no one was allowed in here! You could destroy Candesce on a whim from this place; and if Candesce went, so would go all of Virga.

The thought was disturbing. Hayden's excitement soured as he watched the slow parade of machines sidle through the air towards the visitor's center. This was too easy—there was too much power to be had here. It made him wonder what Venera Fanning would do once this episode was over. Or what the Pilot of Slipstream would do if he demanded and received the Candesce key from the Fannings.

After assuring himself that the machines were doing as he'd asked, Hayden left the little room. He flipped over and under walls, around floors, hurrying back to the entrance and his bike.

Double-check the bike to make sure it was flight-worthy. Tie the sun components he'd found into the cargo net and tie it to the back of the bike. And then . . . rehearse what he was going to say to the others when they saw what he'd acquired.

They would need convincing—particularly Carrier. His plan was to get to the man through his mistress, Venera. If he could convince her that these components were his just payment for his part in this adventure, then maybe she could restrain Carrier.

He flipped around a corner and spotted the entrance.

It was open.

Hayden slowed down and cautiously drew his sword. Had the Gehellens somehow managed to force the door? That didn't seem likely; why now, after so many centuries? Or maybe—the thought gave him a chill—maybe now that it was unlocked, anyone could get in here. He hadn't thought of that. Were the Gehellen airmen inside?

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Hayden could see the first of the packages he'd ordered bobbing in the darkness outside. Despite his worry, the sight made him smile. He looked around the room. There was the bike, seemingly untouched. There was no one else in sight. He moved carefully toward the door.

Carrier swung in from outside to brace himself on the two sides of the entrance. Night was at his back. "So there you are," he said. "I wondered what exactly you were going to try. Of course, I had no doubt that you'd try something."

"This doesn't concern you," said Hayden.

"A new sun for Aerie does concern me."

Carrier drew his sword.

The *Rook* roared through blackness with exhilarating recklessness. Chaison imagined statutes and naval regulations fluttering in the ship's wake, centuries of rules about how fast to travel in cloud all broken in an instant. He pushed the *Rook* to one hundred miles an hour, then two hundred, and watched the dots of the Falcon Formation navy grow into circles, then distinct ship-shapes.

The bridge crew was white faced. Travis perched next to Chaison, his lips drawn thin while his fingers gripped the edge of the chair. Logic said they would run into something at this speed—but of everyone in the bridge, it was the radarman who was now the calmest. "Bear two degrees to port, five south," he would say, or "Six degrees starboard right now." The pilot, flying blind, obeyed with frantic sweeps of the wheels.

"Getting secondary signals," said the radarman abruptly. "Just like she said."

"All right." Chaison smiled grimly. "You know what to do."

Falcon's fleet was creeping slowly through an ocean of cloud; nobody could tell how far the mist extended. He didn't need the cloud, of course, it was night anyway. But if they could strand the target vessels of the Falcon fleet in opaque fog they would still be vulnerable when daylight returned—if the battle still raged at that point.

Meanwhile, he had to deny the enemy all their other assets. "Line up on those bikes," he said. "'Ware our other ships, they'll be doing the same. We're going to scrape the sentries off Falcon's fleet like old scabs."

The engines whined as they accelerated one more notch. There was a sudden dark flicker outside the portholes and then *bang!* The ship twitched to the impact, but ran on.

Chaison winced. They were running over the Falcon Formation's sentry bikes. As when the *Tormentor's* bikes had flown ahead of to watch for obstacles—unsuccessfully, in that case—the Falcon fleet was feeling its way by sending them ahead and to the sides. Lacking radar, the bikes were its only means of safe travel through darkness and cloud.

Another crash against the hull, and another. On the radar Chaison could see the shapes of *Rook's* sister ships overtaking the dots of Falcon bikes, which simply vanished as they passed.

Ahead was the huge but indistinct blob that must be the new dreadnaught—a weapon of terror no one from Slipstream had ever seen except in blurry photos. Ironically, they were unlikely to see it now. If all went well the men of Slipstream would never make visual contact with the enemy they were destroying.

The *Rook* swept out and around in a great circle. Chaison was reassured to see no clear air ahead as they came around for another pass. "Prepare to deploy mines," he said. Then, "Brake, brake!" He heard the flutter-chop of the braking sails being thrust out of the hull and then he was nose-down, Travis clinging to the back of the chair as the *Rook* groaned and began to decelerate. "Engines off!"

In sudden silence save for the rush of wind and the whuffing breath of the braking sails, the *Rook* slid past the invisible dreadnaught and directly into its path.

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"Deploy mines! Out-out-out-now-now-now!"

There was the sound of wind in open hangar doors, and a distant rattle like some monster clearing its throat.

Then thunder.

18

A ribbon of Hayden's blood twisted in the center of the room, as if blindly trying to find him. Carrier had connected with a slash to his cheek.

"Wait!" Hayden backed away. The man's first lunge had taken him by surprise, but he had his own sword out now. Yes, it would be satisfying to counter-attack Carrier, who had killed his family; so much more satisfying to change his mind.

"You still have a chance to save yourself," said Hayden as Carrier braced himself for another leap.

"Save myself?" Carrier laughed. "I'm the better swordsman by far!"

"That's not what I mean. I'm talking about your son."

Carrier's face went ashen white. "Wh—"

"You betrayed him! Betrayed him and had him killed. And it eats away at you. Your life has been barren since that moment, hasn't it? Anyone can see it in the way you walk, hear it in the tone of your voice. I just didn't know *why*, until the other night."

"My life's not your concern," grated Carrier. "Look to your own."

"You don't believe there's any way you could make up for what you did to him. I'm saying there is. Can you even imagine such a thing anymore? There *is*."

Carrier visibly fought to control himself. "No."

"How would you son feel if he knew that, in the end, you took back your choice?—That you let his project succeed?"

Now Carrier was silent, his eyes wide.

"Slipstream will leave Aerie in a few years. Why not leave a viable nation behind? That was all he wanted. Let me bring back the pieces of a new sun for my people; it won't be ready in time to be a threat to you. Why not? Your son's spirit will be reborn in that light. You'll have him back in that way. It's not too late."

Carrier lowered his sword, his face eloquently puzzled at a possibility he'd never even considered. Then, gradually, Hayden saw his features harden again, as if in the end his guilt were all he was really comfortable with.

"It won't work!" he shouted, and then he leaped again.

Four Slipstream cruisers glided silently through the dark. Horns and gunshots sounded in discontinuous bedlam, but in the impenetrable night it was impossible to put direction or distance to any of the sounds.

The courses of the cruisers began to diverge; observers on one ship watched the other silhouettes flicker and fade into the clouds. Now odd objects began twirling past, momentarily flame-lit: men, their limbs akimbo; smoldering flinders; the crumpled rings of military bikes. They shot by the ships with frightening speed, yet it was not they that moved, but the ships.

An order went out: *Brake!* The cruiser strained and shook as the shuttlecock vanes of the braking sails tumbled into the air stream.

Next came the hardest thing. It was drilled into the minds and reflexes of naval gunnery teams never to fire a rocket blindly. Once loosed, ordnance just kept on going and in any military engagement in populated air, shots that missed the enemy would eventually hit another friendly ship—or civilians.

For weeks Admiral Fanning had tried to undo this training. Now the rocket teams waited tensely for the order, uneasily watching each other, the walls, the rocket racks—anything but the depthless black outside the square firing ports. When the order came it was a shock, however expected it had been. "Ten de-

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grees by forty-three!" barked the officer at the speaking tube. The team cranked the racks around and up. "Fire!"

Sere lines of orange light leapt into the mist—five, ten, fifteen in less than a second. Backwashing fumes billowed over the team. Used to this, nobody coughed or moved. Mist swallowed the contrails.

The cruiser's engines whined into life; it was already turning by the time chattering bangs indicated a hit. By the time the enemy triangulated on the incoming rockets' contrails and fired back, the *Rook* would be gone.

Chaison Fanning looked up from the radar screens. Travis was staring at the glowing green circles, shaking his head minutely and muttering. Chaison caught his eye and smiled.

"Look at them all," said the officer. Travis had circles under his eyes; evidently his injured arm was giving him trouble but he hadn't complained, probably hadn't even noticed.

Look at them all. The navy of Falcon Formation spread away into indeterminacy in all directions, knots, clusters, and clouds of ships of all sizes and designations. The *Rook* was weaving recklessly through them at two hundred miles an hour, a falcon among pigeons. The enemy would see the glow of the cruiser's engines for seconds at a time as it lunged out of nothing and before they could train their weapons on it, it would be gone again.

"Admiral, sir!" He glanced back to see the boy Martor saluting him from the doorway. "Sir, we've had to restrain Slew."

"What? The head carpenter? What's he done?"

"Running around telling us to stop. Said it weren't natural to fight a battle this way." The old Martor would have smirked while he reported something like this; this new version, his side still taped up where Chaison had removed a bullet, looked very serious as he held his salute.

"Very good. Keep him out of our way until after the battle." He turned back to the radar.

"These vessels," said Chaison, indicating some boxy shapes on the edge of the screen. "They're troop carriers, aren't they?"

Travis nodded. "They've got the profile. No reason to send those on maneuvers. And they move like they're full."

The fleet had been driving in the direction of Slipstream. Venera's spies had been right, it was an invasion force. Of course, Chaison had known the spies' reports were accurate—or he would never have undertaken this mad escapade. Somehow, though, seeing the ships and their heading made him furious with Falcon Formation for the first time. As though he hadn't really known at all.

"More mines, sir. We can avoid the cloud this time, but they're going to disperse soon. It'll be harder to find a way around them next time."

"Hmmph." The dreadnaught had not stopped when it realized *Rook* had mined the air ahead of it. To Chaison's astonishment and dismay, the huge vessel had simply plowed through the cloud, enduring a staccato barrage of explosions without apparent effect. It was not to be stopped that way; and if it kept going, sooner or later it would reach clear air, and Slipstream's advantage would diminish.

So Chaison was targeting its engines. He'd emptied barrage after barrage of rockets into them but so far the dreadnaught hadn't slowed significantly. Having realized what was happening—if not how it was being done—Falcon was now mining the air around their ships. The mines were tuned to ignore impacts at less than fifty miles an hour, so the fleet continued to grind forward and maneuvering became harder and harder for Slipstream.

"I want to stop the dreadnaught," said Chaison, "but I want those troop carriers taken out as well. Without them there's no occupying force." He gave the order to the semaphore team, who had reluc-

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tantly given up their flags and were cheerlessly using an electromagnetic signaling technique called "radio telegraph" that was based on Mahallan's radar. It let the Slipstream ships communicate instantly, with no interference from clouds.

Travis glanced up at Chaison. "Bit of a surprise about Slew, isn't it?"

Both men smiled—and Chaison was about to say something witty when the green light of a thousand tumbling flares burst through the portholes. The *Rook* had entered clear air.

Hayden dove to the side careless of where he might end up. Free of doubt now, Venera's spymaster was relentless, economical in his movements, and expressionless as he pursued Hayden around the room.

It didn't help that this place was so bare of ornament. The antechamber where the bike had been left had only a few hand-straps on the walls, ceiling, and floor, as well as some cabinets and shelves that didn't make good purchase. The key to a gravity-free sword fight was never to let yourself become stranded in mid-air—and in this place, that was not so easy. As they circled one another Hayden tried to ensure that he had one hand or foot on a strap or piece of furniture at all times. With blank wall at your back, all you could do was jump straight out, and the enemy would know in advance where you were going. And when you dove at your enemy, you made your whole body a missile but you also could not stop until you'd made contact with something; your opponent would attempt to ensure that the something was his sword blade.

Carrier seemed unhurried. There was no indication that adrenalin powered him; it was more like he was going through a set of mechanical motions, cut, parry, dodge, cut. He would keep doing it until Hayden was dead.

Hayden made for the door but Carrier anticipated him. They came together in the center of the room, thrusting with their sword-arms while reaching to try to catch sleeve or foot with the other hand. For frantic seconds they tumbled and then a thrust by Carrier took Hayden through the left bicep. He shouted at the jolt of pain.

Carrier gave a grunt of satisfaction. Hayden tried to pull back but Carrier fluidly moved with him, keeping the blade embedded in flesh as Hayden cursed.

Not so gracefully, Carrier flailed at a wall-strap with his other hand. He caught it—barely—and swung his sword, with Hayden attached, outward. Hayden knew he was seconds away from being placed motionless in mid-air, out of reach of the walls, at which point Carrier could bounce around and cut him to pieces at his leisure.

Desperately Hayden let go of his own sword, grabbed the blade of Carrier's, and *pushed*. The metal slid out of his skin, dotting the air with blood, and then Carrier yanked it out of his grasp, slicing Hayden's fingers open to the bone. Hayden writhed out of the way of the backhanded cut that followed. He tried to snatch his own sword out of the air but it had drifted too far away. He saw then that he really was stranded, two meters from the nearest hand-hold.

Carrier sneered and stood up from the wall-strap, which he'd hooked with his foot. Hayden twisted around again and managed to kick the older man in the face. As Carrier cursed and spat blood, Hayden very slowly drifted across the room.

Carrier dove past him again with a vicious slash. Hayden did as Katcheran had drilled him to do: he rolled into a ball in the air and presented his feet to the blade. The sword chopped right through the tough leather but a cut foot wasn't going to kill him. And the pressure of the blow put him closer to the bike.

His sword twinkled as it turned on the far side of the room. Carrier perched at the inner door now, and was carefully lining up his next jump. This time he would thrust rather than cut, Hayden knew;

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there would be no evading the blow.

He stretched out, reaching for the bike. Carrier laughed. "Even if you can reach that what are you going to do?" he asked. "Throw it at me? Bounce somewhere? I'll never let you get your sword, you know."

Hayden's taut fingers brushed the curving metal of the bike. And Carrier jumped.

"Full about!" Chaison dove for the portholes, missed his grip, and banged his chin on the wall. He pressed his face up against the glass, staring out at vast sensual curves of green-lit cloud. He still had the advantage here, because the dozens of flares drifting out of the cloudbanks lit only a small volume; and the plan had counted on the fact that there were many smaller clouds dotting the edge of Winter. His ships could dive through them with impunity. But while the six battered, obsolete Slipstream vessels still had an advantage of speed and maneuverability here, it wouldn't be enough. Falcon simply had too many ships.

The *Rook* pivoted in mid-course, air tearing at its hull, and Chaison strained to catch a glimpse of what was behind her. Lurid tumbles of cloud; arms and arches of vapor. And emerging from it only one other ship, so far.

"All batteries, target that ship! Don't give it a chance to sound!"

Too late. Even as the first rockets lurched towards the distant cruiser, a faint echo of its clear-air signal came to Chaison's ears. He cursed. "Take it out!" The noise of battle would prevent most of the other vessels from hearing that lone horn—but if only one picked it up, it would repeat it, and so would every other one that heard. Soon the clouds would be ringing with the signal that open air had been found.

He went back to the radar display. The shadow of Falcon Formation's giant ship still lay some miles inside the cloud, and it was slowing. "All ships: put everything into stopping the dreadnaught. Release parachute nets ahead of it, mine the air—*anything!*"

—Hammering sound of bullets hitting the hull. Sudden flame of a missile veering past. He heard the *Rook's* own machine gunners opening up at something. "Put us back in the cloud deck," Chaison commanded as he regained his chair.

The ship took a hit before they managed to escape into the mist. There was chaos over the speaking tube for about a minute, then an all-clear. Chaison frowned at the indiscipline, but most of his attention was on the radar.

They had arrived at this battle late. Daybreak was little more than an hour away. By the time Falcon's suns were glowing full, Venera would have had Mahallan switch Candesce's defensive systems back on.

During this long night of dark maneuvering, Slipstream had thrown the Falcon Formation fleet into disarray, had wiped out its bikes and smaller vessels, and scored crippling blows on a number of mid-sized ships. The troop carriers appeared damaged as well. But that was all—and it was nothing.

If they didn't score a decisive blow to Falcon's invasion plans in the next minutes, the whole mission would have been for nothing.

"Sir!" It was the radar man. "We—I think we've lost a ship."

Chaison looked where he was pointing. One of the fast-moving dots on the screens had broken in two pieces. As he watched the pieces subdivided and disintegrated. The dots dissolved into smudges on the screens.

"Any idea who that was?" Chaison asked into the sudden silence. He scowled at the display. *The damn fools flirted with a mine cloud.*

There was silence in the bridge; the men glanced at one another. "Back to the dreadnaught," Chaison commanded. "I want the cutters packed with explosives—warheads, bullets, everything we've got. Rockets haven't had much ef-

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fect on it, so we're going to ram something bigger down its throat."

And if those don't work, we'll make the Rook *itself into a missile.*

Carrier jumped.

Hayden grabbed the seam of the bike's saddle and pulled as hard as he could.

The cargo net he'd stuffed under the saddle flowered into the air and he spun as best he could, throwing it at Carrier. The spymaster shouted and tried to evade it but he was in mid-leap now and there was nothing he could do. Tangled, swearing furiously, he bounced off the bike and back into the air.

Hayden planted both feet on the metal and pushed. The dive took him across the length of the room and he plucked his sword out of the air before spinning and kicking off from the far wall. Carrier was struggling to free his sword from the net; his awkward parry went bad and suddenly he was staring down at Hayden's sword, which stuck out of his chest.

"Wh—" He tried to reach up; failed, and looked in Hayden's eyes. Carrier was trying to speak.

"Don't talk to me," said Hayden. "The one you need to explain yourself isn't here. You'll see him soon enough." He let go of the sword, turned, and jumped back to the bike. Reaching around the exhaust vent, he caught a loop of the thin cable he'd stashed there before they had left the *Rook*. He pulled out the loop and began to unreel it.

When he was sure Lyle Carrier was dead he unwove the net from around him, and attached the cord to it. Then he moved to the door and looked for the first of the packages he'd ordered Candesce to provide.

Aubri Mahallan was acting very nervous, and it was driving Venera crazy. After the tenth time that the woman bounced a circuit around the room, Venera said, "Is there something you need to do?"

Mahallan shook her head, becoming very still. "No. Nothing."

"Then settle down. It's not your husband who's in the middle of a battle right now. Your man's just down the hall."

"He's not my man," said Aubri quickly.

Venera raised an eyebrow. "Oh? He thinks he is."

Now Mahallan looked uncomfortable; as far as Venera was concerned, that was a definite improvement.

"You don't think the waiting gets to me?" continued Venera. She crossed her arms, glancing once at the indicator device she had stashed in her bag by one wall. It still glowed steadily. As long as it was on, Chaison retained his advantage; so in a sense, its light was her lifeline to him. But she would have to shut it down soon, when dawn came.

"I'm not you," said Aubri, scowling. "I've done a great deal for your little project, Venera. Have you ever asked yourself what I'm going to get out of all this?"

She shrugged. "You never asked for anything, did you? Which is odd, except that you're an exile for whom everywhere is the same . . . But why not take Hayden Griffin? He's a fine catch for someone from the servant classes. Is that your problem with him? That he's not one of your own kind?"

"You wouldn't understand," said Mahallan.

Venera laughed. "On more than one occasion I've been told that my problem is that I do understand people, I just don't feel for them. Which is probably true. But you're right, I don't get it. We've completed our project, you're free and as rich as you want to be. In just a few minutes you can switch the sun's defenses back on, and then all you have to do is take your money and your man and go enjoy yourself. What could be simpler?"

Mahallan looked startled. "Is it time already?"

Venera checked her pocket watch. "Getting there."

"Okay." Aubri smiled; it seemed a bit forced to Venera. Mahallan glided over to

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the wish mirror. "I'll get ready to shut it down, then," she said brightly.

"All right." Venera watched her, keeping her face neutral. As the strange outsider woman gazed into the mirror, Venera let herself drift over to her bag. She made sure that she could see the glow of her indicator, and Mahallan, without turning her head.

Just in case, she loosened the scabbard of her sword.

The dreadnaught was tangled in parachutes and trailed debris in a long smoking beard of rope and timber. Its engines were tangled knots of metal belching black smoke into the air. Its rudders were useless flags.

There were no significant holes in its hull.

The mist ahead of it was brightening as it approached open, flare-lit air. Just a few hundred yards and it would be free of the nightmarish disadvantage of the clouds. Its enemy would no longer be invisible. One shot from the rifled ten-inch guns mounted along its sides and the smaller ships would be matchwood. All it needed was the sight-lines.

As the *Tormentor* slid into position to unloose a salvo, the dreadnaught got its chance. The Slipstream ship had been relying on the veils of mist to let it do what it had done ten times already: stand off, hidden, and pummel the larger vessel before moving to another firing position. This time, though, the intervening clouds proved to be just a thin curtain and when it parted suddenly, the *Tormentor* was unluckily right in the way of a searchlight. The dreadnaught's gunners had been waiting for this.

The first shell convulsed the cruiser with an internal explosion. The next broke it in half. Six more followed, pulverizing the twisting remains before the shockwave from the first blast had died out. The *Tormentor* and all its men were simply erased from the sky.

Rockets continued to rain on the dreadnaught from other directions—but the gun crews were emboldened now and began firing wildly. If some of their own ships were close by, well, too bad; any sane Falcon Formation craft would be headed for that brightening in the clouds by now. Only the enemy would lurk in the darkness, and so into that darkness they fired.

A lucky shell clipped the *Unseen Hand's* stern and blew its engines off. Its crew bailed out, flapping away with foot-wings, but the *Hand's* captain was old, mean-tempered Hieronymous Flosk. He drew a pistol and aimed it at the bridge door. "Any man who tries to leave, dies!" he bellowed. "We're going in! Man your posts, you cowards! Make your lives count for something!"

The *Hand* still had steering and was doing over a hundred miles an hour. When it lunged out of the cloudbank the dreadnaught's gunners had only a few seconds to fire and the one shell that hit bounced off the cruiser's streamlined hull. Then the *Unseen Hand* slammed into the side of the great ship and exploded.

In a zone of half mist, where towering banks of cloud interspersed with pockets of clarity, the dreadnaught shuddered and sighed to a stop.

"Sir." The radarman sounded puzzled. Chaison looked up from trying to catch the flailing straps of his seat belt. The whole ship was rattling now as their airspeed peeled away planks behind the open wound of the hangar doors. They had to reduce their velocity, but a few bikes and cutters were still pursuing.

The radar man held up his chronometer. "Sir, it's daybreak in Falcon. The radar shouldn't be working anymore, but it's holding steady."

Chaison stared at him. What did this mean? Was Venera giving him a gift of extra time? Or had something gone wrong in Candesce?

He might have radar for as long as he needed it . . . or it might cut out at any second. It no longer mattered: daylight

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was here.

The clouds were an abyss of pearl dotted with instants of black—men, burnt-out flares and wreckage only half-glimpsed as the *Rook* shot by them. And coalescing out of the writhing whiteness were the iron contours of the dreadnaught. The great ship seemed determined to keep a pall of night around itself; it had drawn a cloak of smoke and debris around its hull. With each broadside it let loose, the smoke thickened.

"I bet they never thought of this," Travis said, shaking his head. "Rockets take their exhaust with them when they go. But guns . . . They're blinding themselves with smoke."

"It's a gift," said Chaison. "Let's take it while it's offered." He moved to the speaking tube. "Are the cutters loaded and ready? Good. Wait until I give the order and then let them fly."

The *Rook* spiraled around the motionless dreadnaught just ahead of cannonades of deadly fire. Chaison stared through the portholes, looking for any vulnerable spot through the wavering lines of tracer rounds that subdivided the air. Enemy bikes shot past, snarling like hornets, and the *Rook* bucked to some sort of impact.

"Enemy closing from all directions, sir," said the radar man. "It looks like they've got another of ours boxed in too . . . I think it's the *Arrest*. I can't see the *Severance*, but they're still broadcasting."

"Bring us closer," Chaison told the pilot. He'd seen what he was looking for—a triangular dent, yards wide, in the hull of the dreadnaught. The surrounding metal was scored and burnt; something bigger than a rocket had impacted there. He reached for the speaking tube—

—And everything spun and hit at him, walls furniture the men rebounding with the shock of a tremendous explosion. Half deafened, Chaison shook himself and grabbed for a handhold, abstractly noticing that the bridge doors were twisted, half ajar. *Slew's not going to fix this one*, he thought.

He struggled back to the commander's chair. The pilot was unconscious and Travis was shoving him aside to reach the controls. Chaison grabbed the speaking tube and shouted "Report, report!"

A thin voice on the other end said, "They're dead."

"Who's dead?"

"The . . . everybody that was in the hangar, sir."

"Is this Martor? What about the cutters?"

"One's intact, sir." There was a pause. "I'll take it out, sir."

Chaison turned away for a moment, unable to speak. "Son," he said, "just aim it and jump clear. Make sure you've got a pair of wings and just get out of here. That's an order."

"Yes, sir."

Travis had the ship under control and was banking tightly to avoid a fusillade of shells from the dreadnaught. "Sir, here comes the rest of Falcon," he said tightly. Chaison glanced at the portholes and saw a white sky crowded with ships. Just then a large shape obscured the view: the explosives-laden cutter had soared ahead of the *Rook* and was curving down towards the iron monstrosity.

Chaison couldn't look away. Tracer rounds and the shocked air of shell fire outlined the cutter; he saw pieces of its armor shattering and flying away. Then it was suddenly not there, and Chaison blinked away after-images of a flash that must have been visible for miles.

The roar overtook the *Rook*, shaking the hull and starring another porthole. Chaison simply stared at the absence and coiling serpents of smoke. He felt a crush of grief and for a few moments was paralyzed, unable to think.

But everything rested on his decision. He shook off his feelings and turned to Travis.

"Prepare to scuttle the ship," he said.

19

Hayden tied the last of the sun components into the cargo net. His hands were

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shaking. As he fumbled with the cords, he noticed his shadow, hunched and vague, wavering against the grey wall of the visitor's station. He looked over in time to see the metal flowers of Candesce's strange garden closing. Silhouetting one of them was an orange glow that hadn't been there a minute ago.

"Oh no." He finished the knot hastily and climbed back along the cargo net's cables to the open entrance to the station. The bike was tethered there; it too had a shadow—no, two shadows. He looked down and saw that a second sun was opening its glowing eye.

He'd thrown Carrier's body into the open air. His story was going to be that the Gehellens had come back and there'd been a fight at the entrance. The attackers had been driven off but Carrier was killed. He had rehearsed his story over and over during the past hour, while he struggled against the pain of his wounds to fill the nets with sun parts. As he'd done so he'd found himself crying.

He no longer wondered at such tears. As he rehearsed the lie about the Gehellens, Hayden found himself wondering whether he was reluctant to tell the truth to Venera, or Aubri, or himself. Either way, he felt no satisfaction at Carrier's death. The only thing he was proud of was his attempt to talk the man out of attacking him.

So in his head he began to rehearse a second story. This one would not be told until he was an old man, if he got things right. It began and ended with, "Carrier was the last man I killed, or ever wanted to kill."

Once inside the station he climbed quickly from strap to strap, heading for the inner chambers. "We have to go!" he called as he went. "Come on, the suns are waking up!"

Nobody answered. What were Venera and Aubri up to? From his own experience with the wish-mirror, he'd seen that once you set something in motion here, you could pretty much ignore it and go on about your business. Aubri shouldn't have had to nurse Candesce after shutting down its defenses against Artificial Nature.

"Aubri! Venera! Where are you? We have to leave, now!"

He heard a thump from somewhere ahead. Hayden ducked under and over walls, passing through several rooms that seemed familiar. Then, as he was gliding across a half-lit room filled with hammocks and rest nooks, he heard a woman's voice growl a single word:

"Bitch!"

More thumps and a gasp from the other side of this wall. Hayden perched there for a moment, blinking, then swung down to climb into the next room. He stopped, straddling the wall.

Aubri Mahallan and Venera Fanning clung to straps on opposite walls. Both women had swords in their hands, and those swords were pointed at one another. Venera's face was twisted into a rictus of fury, muscles jumping in her famous jaw.

"Turn it on!" Venera screamed. "Turn it back on!"

Aubri silently shook her head.

Hayden somersaulted into the room. "What's going on?" He made to join Aubri, but she dove out of his way.

"Stay back," she murmured.

"Stay . . . ? What's going on?" By now, he was too tired and in too much pain to catch her.

Venera pointed to where her special indicator lamp tumbled in mid-air, its light glowing steadily. "She won't turn it back on. Candesce's defenses! She was willing to turn them off all right, but she won't bring them back. She's opened the gates to her friends from beyond Virga."

"Aubri?" He stared at her, but she wouldn't return his gaze.

He should have figured this out. He realized now that she had given him enough clues over the past week—but he'd been so consumed with the idea of finding components for a new Aerie sun that he hadn't thought through the things Aubri had told him. She had told

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him that she had not been sent to Virga to enter Candesce; but in the same breath she had told him that the assassin-thing coiled inside her was listening for any hint that she might reveal her true mission. Her denial should have tipped him off; but he hadn't been smart enough to see it.

"I'm sorry," she said in a low, shaking voice. "If I turn it back on, I'll die."

"You were sent to bring Artificial Nature to Virga," he said. "That's what you couldn't tell me." She nodded.

Hayden's thoughts were racing. Should he try to stop this? Or should he side with Aubri? "What happens now?" he asked her. "When you let them in . . . What are you letting in?"

Now she looked at him, her expressive features crumpled into sadness. "A trillion ghosts will come first," she said. "The disembodied AIs and post-humans will flood into Virga, make it their playground. They're hungry for resources. They'll transform everything they touch—and everybody. When that transformation happens, your reality will fade away. The walls of Virga will disappear. The suns, the darkness, the towns and ships . . . They'll be erased by virtual realms. Glorious beauty, places like Heaven brought into being around every man, woman and child. Whatever you imagine will come to pass. Everything and anything, except Virga itself. Everything you knew will be gone, replaced by fantasies made real."

Venera shuddered. "We won't survive it," she said.

Aubri shook her head. "Not as you are now," she said. "Whatever your hopes and dreams were, they're obsolete now. You'll need new ones. New reasons to live." He mouth twisted in grief. "And that's the one thing the system can't make for you."

"No!" Venera launched herself across the room. Before Hayden could reach them the two women were twisting in the air, Venera slashing madly at Aubri who tried to parry. Hayden cried out as he saw Venera's sword slide into the muscle under Aubri's left shoulder.

Hayden's lover, the *Rook's* armorer, tumbled backwards streaming blood.

He screamed and jumped, too late, as Venera cursed and kicked off from Aubri's limp body. Venera reached a corner and ducked around the offset panels with one wide-eyed look back at Hayden.

He wrapped his arms around Aubri and turned so his own back took their impact on the far wall. She was jerking in his grasp, twists of blood reaching out of her with each breath.

"I'm—sorry," she gasped. "I was too afraid."

"Hush," he said, smoothing back her hair. "It's not your fault. It's theirs for making you and then condemning you for being who you are."

She closed her eyes and whimpered. "Hush," he said again, holding her close.

"No." She pushed against him. "No! Let me go. Get me to the, the wish-mirror." She pointed at a glassy rectangle on the ceiling.

"Stay still."

"No. Let—" She writhed in his arms, turning to glare at him.

"Let me beat them."

The bridge was full of drifting grit and the stench of smoke. Deafening explosions rattled the beams; all the portholes had shattered. Chaison clung to the arms of his chair and glared out into gleaming sunlight as the *Rook* came apart around him.

"Ready, sir!" Travis was holding onto a pipe with his toes, one-armed as he was with his hand in a sling; his free hand was poised over the scuttling console.

Chaison felt infinitely weary. It wasn't as though it mattered whether Falcon Formation got its hands on the radar sets. There wasn't anything they could do with them. Assuming, of course, that Aubri Mahallan did her job. The idea that she might not seemed distantly worrying, but he couldn't bring himself to focus on abstractions. Instead, he frowned

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past the jagged glass rimming the porthole, at the obstinately solid silhouette of the dreadnaught that was even now turning to aim its biggest guns at the *Rook*.

All I wanted, he thought with an ironic smile, *was to get rid of that thing*.

As the dreadnaught turned it exposed the dented portion of hull where something had collided with it. Sunlight angled around the dark hull and Chaison saw that the ship's armor had split at the bottom of that dent; there was a three-sided hole there.

"Wait a second, Travis," he said. Chaison frowned, then reached for the speaking tube.

"Rocket batteries one and two, are you there?" he shouted.

"Y-yes, sir. What do you want us to do, sir?"

"Don't bail out," he said. "You'll be shot to pieces in open air. I have a plan. Load the racks and get ready."

"Sir!"

He turned to Travis, who was watching him with a raised eyebrow. The radar man and the semaphore team were also staring. "Get to the helm," he told Travis. "We've still got power. We're going to ram her."

"Ah. I see." Travis looked faintly disappointed. Chaison had to laugh.

"No, you don't see," he said. "We're going to ram her *there*." He pointed. Travis began to smile.

The *Rook* ducked out of the path of the big guns, angling up and shooting straight at the line of Falcon Formation battleships that was bearing down on her. They were momentarily safe since the ships would not want to miss *Rook* and hit the dreadnaught.

The *Rook* groaned as Travis spun them around and lined up on the dreadnaught. "They're going to get at least one good shot at us, sir," he said.

Chaison shrugged. "Have you got a better idea?"

Travis didn't answer, but merely pushed the control levers forward. Chaison heard the distant engines whine towards full power.

"If you do want to bail out," he said to the semaphore team and the radar man, "now would be the time to do it."

Nobody moved.

"All right then."

Holed, dripping splinters and chunks of armor, the *Rook* accelerated for the last time. The air it crossed was layered with smoke and debris, the bodies of men, and unexploded ordnance. Chaison watched it all pass in disgust. *How pointless*. He wasn't sure whether it was Falcon's invasion that he meant, or his own attempt to stop it.

"Brace for impact!" He strapped himself in and spun the chair around. It was designed to handle collisions like this; the *Rook*, like her sister ships, had a substantial ram on her prow. She never intended to ram something as big as a town, though. This whole gambit might just provide a good laugh to the Falconers, if *Rook* simply splatted against the dreadnaught's skin like a bug on a porthole.

He closed his eyes, and thought of the home he would never see again.

The impact, when it came, was surprisingly gentle. A vast grinding sound filled Chaison's ears and the ship shuddered and bucked. Then it eased to a stop. In the swaying light of the gas lamp, he met Travis's eyes and grinned.

"Let's see where we are." The portholes were blocked by wreckage. Both men jumped over to the bridge doors and Travis flung them open. Chaison gasped at what he saw.

The *Rook* was holed in dozens of places. Its interior was a shambles, with dead men and parts of men, tangled coils of rope, broken bulkheads and spars thrusting every which way. Way down past where the hangar had been, streams of sunlight made bluish shafts across the space. Nearer, the holes in the hull revealed only darkness.

"We're jammed inside it," Travis said wonderingly. "More than half way."

Chaison nodded. "That's what I had in

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mind." He clambered through the wreckage, heading for the rocketeers who huddled next to their bent racks. "Ready to fire, men?" They stared at him.

Chaison laughed recklessly. "Come on!" he shouted. "This is the stuff of legends! We're going to rake this bastard of a ship with a barrage that'll tear it to pieces—and we're going to do it *from the inside!*"

Still they hesitated—and then a loud voice burst out, *"What are you waiting for?"*

It was Slew, smoke stained and trailing a broken chain from his wrist as he flew up from the aft. Beside him, helping him maneuver past the wreckage, was Ambassador Reiss. Both men had swords in their hands; both looked grimly determined.

"You heard the admiral!" yelled Slew. The men looked at each other, then leaped to their posts. Already Chaison could hear gunshots, and just behind Slew soldiers in Falcon Formation uniforms began pushing their way through gaps in the hull. *The irate crew.* Well, they were too late.

"Reiss, Slew, behind you. You men—fire!"

The port and starboard racks unleashed their rockets and the *Rook's* hull tried to collapse as everything outside blew up. Some of the rockets must have found their way down long passageways, exploding hundreds of yards away. Some didn't get ten feet. But the dreadnaught had never been designed to withstand this kind of attack. As the rocketeers cleared their tubes and made to load another round, the *Rook* was hammered by new explosions, much bigger than those they had caused. Now the hull really was collapsing, Travis grabbing at a stanchion, Reiss and Slew's faces lit with surprise and all of them disappearing into bright sunlight as the ship sheared in two and the sky filled with gouts of smoke and flying darkness.

Somehow, Chaison had caught a rope and found himself dangling over the infinite airs of Virga, watching while the aft half of the dreadnaught fell away and wrenched itself to pieces with explosion after explosion. Mesmerized, he didn't look away from the sight until he felt the rope being tugged from the other end. He glanced up.

The shattered half hull of the *Rook* still stuck out of the fore half of the dreadnaught, right at the spot where the great ship had been torn in two. Smoke billowed out of the forward section but it hadn't exploded. Three Falcon airmen were hauling in the rope Chaison held, murder in their eyes. Of the rest of his crew, there was no sign.

"Gentlemen," Chaison said as he held out his hand, "meet the man who beat you."

Venera watched Hayden Griffin weep. A fluttering sense of disquiet plucked at her; she fought against it fiercely.

Aubri Mahallan moved feebly in the young man's arms, gesturing at the wish-mirror in front of which they floated. Venera clutched her sword in sweating hands and wondered why Lyle had not shown up yet.

The indicator light for Candesce's defenses still spun lazily in the air. Without fanfare, it suddenly went out. Venera frowned at it. Had its little battery died, or . . . She looked at Aubri Mahallan.

The woman's limbs drifted free now, and her head slowly tilted forward. Griffin gave one last wracking sob and then spun to look at the wish-mirror. It was a rectangle of white light now, all details washed away by the awakening suns.

Griffin turned again, and now he looked straight at Venera. Despite herself, she flinched from his glare. But all he said was, "We have to go."

The words made no sense at all; Venera could barely believe she'd heard them. "I killed your woman," she said. "If I come near you, you'll kill me."

"No," he said.

She sneered. "Oh? Where's Lyle?" Griffin looked away, and Venera's heart sank.

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"He's not coming, is he? You boys finally settled your little dispute, whatever it was?"

He gathered Mahallan's body in his arms again, and kicked off towards an open corner. "What choice did I have?" she called out after him. "You know what she tried to do!"

"Shut up," he said without looking back. "Just shut up."

Venera was furious and, yes, scared; but she wasn't going to back down. Not to this servant. "So strand me, or shoot me," she cried. "I did what I had to do."

Now, just before disappearing around the corner, he did look back. He looked sad, and puzzled. "Venera, I'm not going to kill you," he said. "There's room on the bike. Come with me."

"That would mean trusting you," she said.

"Yes."

Venera laughed, and hunkered down a little more in the shadows. "I've never done that in my life," she said. "I'm not about to start now."

"Suit yourself," he said with broken weariness. Then he was gone.

Venera remained where she was for long seconds. Outside, Candesce was rousing itself to full power. She couldn't feel the rain of invisible particles that Mahallan had said would flood this place during the day, but she imagined them like virulent poison seeping through the walls. Even if the heat didn't kill her . . .

But trust a man whose lover she had just killed? The idea was insane. Trust Griffin? Trust *anyone?* There were fools who did it and survived somehow. She could not be so lucky, she knew.

Venera fingered her jaw angrily. She would die here, miserable, abandoned.

When the bullet hit her and she lay moaning on the stone she had waited—waited for someone to come to her, to discover her in pain. She had waited for the cries of distress, the solicitations of her rescuers. Nobody came. There was no rescue for Venera Fanning. So in the end she had crawled, herself, unassisted, through the corridors and into the Admiralty. At the last second she had fainted, before knowing whether the ones who found her had cared enough to hold her as Griffin had held Mahallan, whether they wiped her drying tears and murmured that she would be all right. When Chaison tried, much later, it was too late.

Venera spat a curse, and uncoiled from her defensive knot. As quietly as she could, she crept after Hayden Griffin through the dimming rooms of the station.

Heat and intolerable light met Hayden at the entrance. The bike's handlebars were almost too hot to touch and he had to squint and grope for a loop of cable to wrap around Aubri.

He didn't have enough to tie her to the saddle, so he looked around for another solution. Put her in the cargo nets? Maybe—if he could get to them. The heat scored his face whenever he turned towards the suns; the very air was attacking his mouth and lungs. He wasn't sure he could jump over to the nets and get back before the heat took him.

You've lost her already. Like he'd lost everyone else in his life. He should be used to this by now.

Heartsick, he gave her body the slightest of shoves, and she slipped through his fingers—waist, shoulders, finally one trailing hand smoothing his before the moment of separation. Aubri Mahallan vanished into light.

Hayden turned and climbed onto the bike.

He spun up the fan and the burner started immediately. As the jet's whine escalated he clung to familiar routines, listening to it, judging the health of the machine. He jiggled it with his knees, estimating how much fuel was left. Hayden knew his machines, and this one still had some life in it. A few refuelings and it would get him back to Rush, he was sure of it.

And then . . . He fingered the pockets of his jacket, which were full of jewels

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and coins from the treasure of Anetene. He probably had enough to hire the artisans he'd need. The core components of Aerie's new sun were already in his possession. He might not even need the help of the Resistance to get it built.

Unsmiling, he opened the throttle and began to move away from the visitor's station. There was a lurch as the cable tautened and the nets fell in line behind the bike. That cargo would slow him down, of course. He might meet the Gehellens on the way out. He couldn't bring himself to care much.

But he had to care. What if they got into the visitors' center? Better close the door. He glanced back, and saw that the entrance to the visitors' station was already shut. Crouched beside it in a hurricane of radiance was Venera Fanning.

The cargo net was passing her, just a few yards away. Her eyes met his; there was no appeal in her gaze, just defiance. Hayden nodded once, then deliberately turned back to his piloting. After a moment he felt a slight jerk translate up the cable and through the bike as Venera caught and clung to the passing net.

He opened the throttle and the bike accelerated, but slowly, too slowly as the inferno of dawn welled out from the heart of Candesce. He imagined he could hear the familiar low hiss of the sun of suns, even over the scream of the bike. In minutes it became impossible to see; then he could no longer breathe except in shallow gasps; and then he started to tear at his clothing as it burned him wherever it touched. All the while, the air rushed past faster and faster. Before he completely lost his senses he stopped himself from throwing away his jacket and shirt. The light burned his bare skin as much as their touch had.

Gradually the agony abated. Candesce was reaching out to ignite hundreds of miles of air, but he was escaping it, barely.

Squinting ahead, he could see many long fingers of shadow reaching past him. Catamarans or bikes? He turned his head, trying to make out what they were.

Everywhere, the sky was full of shrouded human bodies, all gliding silently in toward Candesce. Joining Aubri. The faint specks of a hundred funeral ships receded into the distance, returning to their ports after unloading their cargoes.

When he was finally able to regain his flapping shirt and jacket, and look around himself, Hayden found that he had no idea where he was. Originally they had planned to navigate by keeping Leaf's Choir in view. They would head for one of Gehellen's neighbors, and from there return to Slipstream. Hayden could be going in the opposite direction now, for all he knew.

It didn't matter. He would find his way, eventually. He couldn't imagine spending the days and nights without Aubri beside him; it seemed impossible that he had done so before. But he had to try. He had responsibilities now.

A few minutes later he felt another vibration through the cable. He looked back, shielding his eyes with one hand.

Venera Fanning made a black cross against the sun of suns as she launched herself into the air. They were doing a good sixty or seventy miles an hour at that moment; she swept her arms ahead of her in a diving posture and arrowed away, clothes fluttering.

With luck and a good tail wind, she would make it to the principalities of Candesce. Though he wished achingly that it could be Aubri silhouetted in exuberance against that fearsome light, he hoped Venera would survive and find her way home.

Hayden turned back to his own task. He was done with fighting, done with brooding over the past. His nation and his life had been in shambles for too many years; it was time to rebuild.

He had too much to do to waste his time with resentment.

He settled into the bike's saddle, and opened the throttle wide. ■

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Counting Heads, David Marusek, Tor, $24.95, 336 pp. (ISBN: 0-765-31267-0).

Voidfarer, Sean McMullen, Tor, $27.95, 397 pp. (ISBN: 0-765-31437-1).

The Children of the Company, Kage Baker, Tor, $24.95, 300 pp. (ISBN: 0-765-34155-X).

Dragon America, Mike Resnick, Phobos, $14.95, 289 pp. (ISBN: 0-9720026-9-3).

All Eve's Hallows, Dean Wesley Smith, Phobos, $13.95, 286 pp. (ISBN: 0-9720026-6-9).

Moon's Web, C. T. Adams and Cathy Clamp, Tor, $6.99, 337 pp. (ISBN: 0-765-34914-0).

Orphan's Destiny, Robert Buettner, Warner, $6.99, 307 pp. (ISBN: 0-446-61430-0).

Hal's Worlds, Shane Tourtellotte, ed., Wildside, $15, 228 pp. (ISBN: 0-809-55073-3).

Cultural Breaks, Brian Aldiss, Tachyon, $24.95, 237 pp. (ISBN: 1-892-39126-0).

Anatomy of Wonder, 5th ed., Neil Barron, ed., Libraries Unlimited (Greenwood), $80, 996 + xx pp. (ISBN: 1-59158-171-0).

The E-Bomb: How America's New Directed Energy Weapons Will Change the Way Future Wars Will Be Fought, Doug Beason, Da Capo Press, $26, 274 pp. (ISBN: 0-306-81402-1).

The Discoveries: Great Breakthroughs in 20th Century Science, Alan Lightman, Pantheon, $32.50, 592 pp. (ISBN: 0-375-42168-8).

David Marusek's first novel, ***Counting Heads***, is quite interesting, but it has problems. The tale begins in the 2090s, when the world holds some fifteen billion people. That's a number that would have seemed believable a few years ago, but current demographic projections do not support it. In fact, global population now seems likely to peak at about eleven billion before starting a slow decline.

Some of the technological aspects of Marusek's future—such as virtual meetings replacing flesh meetings, rapid genomic analysis, and powerful artificial intelligence—seem more likely. The cloning of vast numbers of servants seems much less so. With nanotechnology he follows the high road of assemblers that can make anything, given raw materials, and disassemblers that can turn cities into goo. Some experts in the field, let us note, think these are highly unlikely.

Be that as it may, Marusek's nanotechnology has made people immortal but—since the advantages as always accrue to the wealthy—has also prompted a terrorist attack that left America with a deadly fear. Cities live under nano-filtering domes, and Homeland Security has released hordes of "slugs" that randomly sample people's blood in search of rogue nano. Artist Sam Harger is partnering with the wealthy and powerful Eleanor Starke when they are surprised by two things: First, Eleanor gets appointed to high government office. Second, they receive an almost impossible

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to obtain birth permit. But before their genes are melded to take over a stored fetus (confiscated from an illegal pregnancy), a slug tags Sam as infested. Homeland Security promptly confiscates him, turns him into goo to clean him out, scrubs his genome from everything he has ever touched, and finally releases him as a "seared" person. They don't trust their own work, you see, and now any of his cells that are harmed, separated from his body, or even too closely scanned will self-incinerate. He also stinks to high heaven. And if he gets PO'd enough, all he has to do is bang his head on a wall to start a major fire.

Someone wants Eleanor to toe a line. The birth permit is a carrot. What happened to Sam is the stick. But there's no real clue to who that someone is. Forty years later, Eleanor is in a virtual meeting discussing the plans for the Oships (planned to take to the stars colonists who pay for their tickets with land, giving the rich eventual title to Garden Earth; some want them to stay home as habs) when the spaceship she is in goes out of control. It's not supposed to be possible, but something or someone has infiltrated the ship's software. The crash kills Eleanor; only the head of her daughter, Ellen, survives, frozen in a safety helmet. And that's when things get interesting, for Eleanor's AI or mentar, Cabinet, is captured for probate and when it is released, it is not quite what it was. The head is taken to a clinic but turns out to be a decoy. The real one is found and taken to the same clinic, but revival and regrowth efforts don't seem to work. Meanwhile, Ellen's mentar is organizing a rescue effort involving members of the cloned servant class, Sam Harger, and a ragtag few ordinary folks.

What the heck is going on? Marusek never really says. Perhaps it is all due to Eleanor's political rivals, of which there is no lack. Perhaps the mentars are getting out of hand. Perhaps it is something else entirely. All the reader knows is how the rescue effort turns out, followed by a hasty, vague ending in which immense changes are hurriedly glossed over. I have a feeling a much fatter book was cut in two, the wound was patched over rather clumsily, and we will soon see a sequel.

And Lo, when I check Marusek's blog, I see that the original book was in fact cut in two, but then it was put back together. There's a sequel coming, but not for the reason I suspected. He's just on a roll.

Sean McMullen has given us a sequel to *Glass Dragons* that is entirely worth reading for its own virtues. And it doesn't hurt a bit that it contains a double homage to H. G. Wells.

Voidfarer centers on Wayfarer Inspector Danolarian Scryverin, once a prince of Torea, a land destroyed by an excess of sorcerous ambition. He is accompanied by, among others, one Wallas, once a lecherous courtier but now a corpulent cat, and Riellen, a young rabble-rouser fixated on the notion of electocracy. They are seeking an abdicated empress when bursts of smoke appear on the face of the Red Moon, Lupan. A few days later, a mysterious cylinder crashes into the ground, the top unscrews, tentacles appear, and a heat ray zaps anyone unlucky enough to be in sight.

Soon Wellsian tripods are stalking across the countryside, and Danolarian—in between efforts to set his romantic life in order and to stay out of any sort of leadership role that might awaken the self he was trained for in Torea—is doing his best to defeat the foe. The foe falls, of course, but I won't tell you how except to remind you of the Wells homage in the tripods, which isn't quite to the point but is nevertheless a clue. The other homage I will only hint at by saying it resembles a bicycle.

Is that too cryptic? Then I must add that you are sure to enjoy this one and look forward to the next in the "Moonworlds Saga" series. The humor is sly

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and frequent, the pace relentless, and the characters convincing. McMullen has the gift.

Kage Baker has earned praise for her tales of the Company, a future-based outfit that "recruits" throughout time, turns its new troops into immortal cyborgs, and sends them out to fill in the blank spots of history, collect treasures before they are lost, and defend the Company's interests. Her last novel, *The Life of the World to Come* (reviewed here in April 2005), dealt with Alec Checkerfield, an engineered tetraploid based on an extinct human species, who just may become the nemesis who accounts for the Company's apparent demise in 2355.

Alec, however, is but one of ***The Children of the Company***. The focus here is on the factions within the Company's troops, in particular that of Labienus, who craves to supplant the company's mortal masters and run the world right. There is also his recruiter, Budu, one of the ancient ones whose mission was to destroy the killer tribes and let civilization take root. He's still around, not yet put on ice, and he resents being taken off the job. There's Aegeus, who has captured a few of a human subspecies with a huge talent for invention. And all are busily snatching children from the slaughtergrounds of history, both for the Company's purposes and for their own, and without much regard for the kids' feelings. Think of San Francisco, 1906, the eve of the great quake. The Company's troops are out in force, looting the mansions of the treasures—artwork, rare manuscripts, furniture, chandeliers, wine, cash, jewels—that will be destroyed. And Victor, one of Labienus's boys, is befriending a laborer and his family so he can sneak into their tenement and spirit away a boy before the building collapses and kills the family.

The mode of the tale is episodic and reflective. It fleshes out Baker's history of the world and sets the stage for the final confrontation (or so I fondly think). Labienus is ruminating on his plans, thumbing through old files, remembering incidents scattered across time. He helped create civilization in Ur, but he's not a nice fellow, not at all. In Ur he gloried in his role as lord and master, battening on the labor of mere mortals. Now he's willing to thin the human herd quite drastically to further his dreams. But though he knows of Alec Checkerfield's predecessors, clones that displayed their powers in centuries past and then died, of Alec he knows only that a third *Adonai* exists.

When the two meet—look for the next volume!—there should be fireworks.

Dragons are really quite unlikely, but they are a fixture of fantasy, presumably because people love them. So perhaps it's no surprise that Mike Resnick should have a little fun—for both himself and his readers—with ***Dragon America***. In his alternate reality, the New World turned out to be infested with all sorts of the beasts. One might have expected such a difference to have created a wildly divergent history, but no. The American Revolution is right on schedule, and George Washington is hard-pressed by the British. Fortunately, he has sent Daniel Boone off to recruit Indian allies. When Daniel doesn't have much luck, he hares off into the wilderness in search of rumored huge flying firebreathers he can bring back to aid the war. Meanwhile, closer to home, Washington's clever New Englanders are turning dragons into homing pigeons.

You get the idea. Not a serious bone in its body, good fun, and a fast read.

Dean Wesley Smith returns to our attention with ***All Eve's Hallows***. The premise is that dragons, giants, fairies, goblins, unicorns, etc., live among us disguised as butchers, bakers, and lawyers thanks to an age-old treaty enforced by the City Knights. Unfortunately, an evil sorceress is bent on awaken-

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ing an ancient evil. Fortunately, ex-Marine Billie Stein has just been recruited to the Knights, and she has a load of powerful if untrained magic. As evil creeps into the New York air, she learns fast. It's a good thing, too, for All Hallow's Eve is fast approaching, and that is when the stuff is scheduled to hit the fan.

For added interest, her recruiter is a hunk and it seems likely that romance is in the offing.

My attention in this column goes mostly to SF (in line with the nature of the magazine), but if you've been following the column very long, you are surely aware that my attention wanders. I have even been known to review poetry! So you should not be terribly surprised if I finally pick up one of Tor's new line of paranormal romances.

C. T. Adams and Cathy Clamp began with *Hunter's Moon* a series in which the world is infested with were creatures. There are werewolves, of course, but also werejaguars, werepythons, wereowls, and more. And when Mafia assassin Tony Giodone gets his throat ripped out by a target, he becomes a werewolf. Soon a sexy young thing tries to hire him to kill her, but Sue turns out to be his soulmate, complete with telepathic resonances, including during the obligatory hot and steamy scenes. When ***Moon's Web*** opens, they are living in Chicago while Tony tries to shift from being a lone wolf to being the junior member of a pack. He's also being asked by an old Family friend to track down a kidnapped lover and bring back the kidnapper's head, even as he starts seeing visions of other people's lives and the werefolk call for the all-clan council to meet in Chicago. Life is hectic, and it doesn't help when his Sue-addiction starts driving her away. Then a body shows up, marked by a mysterious odor, Tony is tasked with security for the council meeting, people start calling him a seer, and more weres are kidnapped amid scuttling shadows and whiffs of that same mysterious odor.

It's a ripping good read, with enough action and suspense for anyone. If you like romances, there's enough of that, too, and if you don't, you can skip the sex scenes without missing much. And I think it's safe to say there will be one or more sequels.

Robert Buettner's ***Orphan's Destiny*** (sequel to *Orphanage*) should satisfy unrepentant fans of Heinlein's *Starship Troopers*, Haldeman's *Forever War*, and the like. Buettner posits a horde of slug-like aliens ensconced on Ganymede, from which they bombard Earth with rocks. In the earlier novel, Earth, led by the US, revived moldering space programs, recruited ten thousand troopers orphaned by the bombardment, and sent them out to do their best, which required ramming their transport into the alien base.

Destiny opens with the seven hundred survivors, led by now-General Jason Wander, being picked up for return to Earth, where the politicos want to pat themselves on the back and reassure the populace that the crisis is over. However, Jason isn't much of a political animal. "Not proven," he insists, despite threats to career and pension. "They may still be out there. They may come back. We need to be ready." (I paraphrase.)

Of course, he's right. The Slugs left behind a number of mysterious objects, one of which has been brought to Earth to serve in due time as the trigger for a renewed crisis. And that's when Jason must go back to war. Right from Chapter One, the reader feels rather bleak about this, for Buettner introduces Jason with his back against the wall and out of ammo, with the Slugs about to descend. But this is SF in the classic mode. After suitable melodramatics and bafflegab (would you believe The Return of Cavorite?), the chestnuts do get hauled out of the fire.

***

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Hal Clement died on October 29, 2003. Not long after, the members of Hal's Pals, the writer's group he had long mentored, began to discuss doing a memorial volume. The result is ***Hal's Worlds***, edited by Shane Tourtellotte. Contributors include such well-known writers as Paul Levinson, Walter Hunt (who contributed an original short story), Jack Williamson, Allen Steele, Michael Swanwick, Stan Schmidt, David Gerrold, Ben Bova, Jeff Carver, Joe Haldeman, Michael Burstein, and Julie Czerneda. The contents include reminiscences, reprinted stories that owe something to Hal's inspiration, a previously unreprinted story by Hal, a Darrell Schweitzer interview with Hal, and a few words from Hal's widow, Mary Stubbs.

Everyone donated their work. Neither the editor nor the contributors get a dime. All proceeds go to two charities chosen by Mary Stubbs, the Joslin Diabetes Clinic and Milton Academy, where Hal taught science for many years.

The people who made science fiction what it is today are almost all gone now. But they are not and should not be forgotten. Biographies help, but books like this one, created out of and embodying a huge amount of love and respect, fill a very different niche. You don't have to buy the book to honor Hal's memory, but go ahead. Do it anyway!

Tachyon Publications celebrates Brian Aldiss's eightieth birthday with a new collection of stories, ***Cultural Breaks***. The stories go all the way back to 1968 ("Total Environment") but are mostly recent. The title suggests sudden attacks of cognitive dissonance, and indeed the lead story, "Tarzan of the Alps," is a perfect illustration of just that. A traveling cinema shows an old movie in the back country, and illiteracy leaps to a remarkable misunderstanding.

Aldiss's career is well worth celebrating. Buy the book, and blow out a candle.

* * *

The fifth edition of Neil Barron's invaluable reference work, ***Anatomy of Wonder: A Critical Guide to Science Fiction***, is now available. If you have used it in the past to look up thumbnail sketches of famous novels or to find out what is available in the way of other reference works, criticism, history, author studies, teaching materials, etc., I need say no more than that the book has been brought up to date, covering not only another decade's worth of the field's best but also vastly expanding the coverage of online material (the fourth edition appeared in 1995, when the World Wide Web was very young). If you have not used it before, those sketches of novels fill nearly 400 pages of the book, they focus on what the contributors consider the best (many writers are therefore absent), and they add up to a remarkable overview of the field as well as a 1300-book reading list for anyone ambitious enough to dream of reading all SF of importance.

However, the index is inadequate, for it fails to cover the first 90 pages of the book, which consists of essays on the history of the field. Anyone interested in that material, or wishing to see where entry (e.g.) II-1305 (Zebrowski's *Macrolife*) fits into the history will be frustrated.

Highly recommended—warts and all—to anyone interested in the history and scholarship of the field. An essential acquisition for libraries of all kinds.

Since Doug Beason is a familiar name to you, you may be interested in ***The E-Bomb: How America's New Directed Energy Weapons Will Change the Way Future Wars Will Be Fought***. The theme is lasers, microwaves, and force fields (or pain-causing energy beams), Beason is an expert in the field, and he explains the details at a level that should be comprehensible to any educated adult.

If his forecasts are right . . . Just keep

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watching the news.

Reading an essay in the latest *Communications of the ACM*, I find the line, "Computer science is one of the most exciting scientific endeavors in recent history," and I think, "Of course!" Computer science was almost wholly a creation of the twentieth century, the product of a corps of extraordinarily high-caliber thinkers (Shannon, Weiner, Turing, Godel, and more), and it has arguably done more to change our daily lives than any other area of twentieth-century science and technology. (The assembly line and the internal combustion engine may have done more, but these extend back into the nineteenth century.)

The same day's mail brought an advance copy of novelist and physicist Alan Lightman's ***The Discoveries: Great Breakthroughs in 20th Century Science***. Lightman's approach is to discourse intelligently and eloquently on 22 such seminal topics as hormones, DNA, the quantum, special relativity, antibiotics, quarks, and synapses and attaches the original papers that announced each discovery (sometimes abridged). The result is an impressive volume, essential to any educated person's library.

But where are Godel, Turing, Shannon, Weiner? Lightman restricts his coverage to physics, chemistry, biology, and astronomy. Mathematics, information theory, and computer science are quite absent. So, for that matter, is anthropology, which in the 1920s saw the discovery of our australopithecine roots. Paleontology could have had a chapter, with the discovery that a comet or asteroid impact wiped out the dinosaurs dating only to the 1980s.

Of course, Lightman's book is already fat, and to be fair, he does claim to cover only *some* of the great discoveries. If the book sells well, perhaps he will do a second volume to cover a few more.■

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BRASS TACKS

Dear Dr. Schmidt,

It is very late in the evening, and I just finished a long day. I read your editorial in the November 2005 issue to relax a bit—but for the first time ever, I am moved to write a response. This fact is significant as I have been an avid and faithful reader of my beloved *Analog* for almost forty years.

I could not agree more with your stance, sir—and I have put my money where my mouth is for all of my professional career. I am a nurse, and for many years practiced in the specialty of obstetrics/gynecology. Part and parcel of caring for women is realizing that sometimes they are pregnant and they do not want to be. All moralizing and posturing aside, this fact remains. I have always believed that a woman should be able to choose whether or not she is pregnant. She should choose in advance—but only because it's less mess and bother that way. And not all sex is consensual.

When I was a student nurse, I had to do a clinical rotation and attend lectures about caring for psychiatric patients. One of the accepted treatments for depression at the time was electroshock therapy. I had seen what its aftereffects had done to my mother, and I could not tolerate even watching the convulsions that the shocks caused on film—let alone in real life. But it was an accepted treatment modality at that time. I chose not to become a psychiatric nurse. I have done a variety of kinds of nursing in the course of 30 years—but never "psych nurse."

My introduction to the process of elective termination of pregnancies was in a busy OB/GYN office as a relief staff nurse. The doctors made it very clear that abortions were performed at this office, and if a nurse had any objections to this she should not accept a position with them. They were good doctors and they did not lack for staff. And the abortion patients got good, safe care just like everyone else.

At the end of my clinical career, I worked at a local hospital in a high-risk obstetrical setting. Pregnancy terminations were done at this center only after they had been reviewed by an ethics committee, and only for serious maternal and/or fetal issues inconsistent with life. No elective abortions were performed at all in this setting. Many of the nurses were devout "believers" and would not participate in the terminations. By this, I do not mean that these "Christian" nurses would not take an assignment of this type—they would not answer the woman's call light to help her to the bathroom or bring her a drink of water or something for pain. They felt (and said loudly, at the nurses' station) that they could not "condone" the abortion because of their beliefs. It was like the suffering woman in the bed was not even human to them any more. I cared for a lot of these women, and I can tell you that a soul in that situation is a very needy patient. And she is *not* having a good time.

Thank you for the chance to speak my piece—even if it never makes print. I am reassured to know that someone out there understands the basic precepts we all should have learned in seventh grade civics class.

Lucie S. Krueger, RN
Phoenix, AZ

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Dear Stan,

Accepting a pharmacist's "right" to keep his/her job after refusing to fill a prescription that counters his/her own religious faith could have interesting consequences beyond those that your November editorial detailed.

If I train as a pharmacist, find employment in that field, and subsequently convert to Christian Science (or some other faith that frowns on *materia medica*), I could refuse to fill any prescriptions whatsoever—yet (on the "right to refuse" theory) I would have a "right" to continue to draw my paycheck simply for standing behind the counter and saying "No."

Religious beliefs of one Hindu sect, the International Society for Krishna Consciousness (ISKCON), reportedly include flat-Earth astronomy with our solar system's other planets (presumably also flat) designed, ruled, and inhabited by the various Hindu deities. Beliefs and teaching of the society also include (again, reportedly—I draw my info from ex-members) a history in which, for several million years, India ruled the Earth, and a biology in which men's brains have twice the weight and volume of women's brains.

If someone makes men and women's safety helmets, and the women's (or men's) helmets fail to protect their wearers because of miscalculated skull weights and volumes, presumably the helmet-maker (if he or she has an ISKCON membership card) can escape legal consequences by pointing out that "According to my religion I have calculated correctly. Therefore, the helmet must have fit."

Kate Gladstone

Dear Stan,

I just read your "Diffuse Tyranny" editorial in the November 2005 issue. I know you to be an intelligent, reasonable person, but I think you really missed the salient issue here.

You view with alarm the actions of some pharmacists who refuse to fill prescriptions for medications that offend their moral sensibilities. But you conflate this with that pharmacist "overruling" the physician who wrote the prescription. Does this pharmacist then work for said physician, so that such "overruling" is a violation of job policy? No, the pharmacist is a free agent just as much as the doctor or the patient. You say that the pharmacist is "employed to fill whatever legally written prescriptions are presented." This is manifestly incorrect. The pharmacist is employed to follow the policies of his employer, and if self-employed to make judgments as he sees fit. If a customer doesn't like those judgments, he should take his business elsewhere. Don't tell me that isn't realistic sometimes. If enough customers agree on this point, there will be some other pharmacist to meet their needs. Or they can go to the internet. Whatever. But it's not justification for forcing someone to violate his or her moral tenets.

Let me give you a homologous scenario that I suspect you would answer in exactly the opposite way. Suppose a sporting goods store owner is deeply morally opposed to firearms. I as a customer would like to buy a rifle from said store. Should the owner be forced to sell me the rifle even though he finds it morally repugnant? My answer is no, he shouldn't. I think you will agree with me here. But this is exactly the same scenario you give with the pharmacist; the product sold is the only difference.

When you say that in some areas Christian "Fundamentalists" are forming an increasingly aggressive majority to do what they want rather than what the law says, I'd like to have some specifics. Your pharmacist argument doesn't show that at all. When it comes to the refusal to teach evolution in the public schools (assuming that the district is requiring such teaching) you have a point and said teacher should be disciplined and fired if he continues to refuse.

You say that the honorable thing for a

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pharmacist to do who doesn't want to fill prescriptions he finds morally repugnant is to quit pharmacy? We must have different definitions of honor my friend. It is in no way dishonorable to abide by your deeply held moral convictions; it would be dishonorable to do otherwise. And yes, others have as much right to their possibly conflicting beliefs as you do. That doesn't mean that you should subrogate your beliefs to theirs whenever they conflict.

Finally, you speak of our own "grassroots Taliban." From my point of view, we've been developing this for some time in the world of "political correctness," attempting to force any conflicting viewpoints out of public discourse. It really has taken on the trappings of a secular religion. What you are viewing with alarm may just be a backlash to the very phenomenon you're hoping to forestall, but which has been happening beneath your notice for some time.

Doug Loss

Suppose the pharmacist's objection is not to selling birth control pills, but to selling insulin or antibiotics. Do you think we must allow him or her the freedom to refuse to fill those prescriptions, too?

The analogy is at least as valid as your gun analogy, which seems to me hardly comparable. Hardly anybody needs *guns to live (in our current culture), but many need drugs. Pharmacies are the only access people have to them, and doctors, not pharmacists, are supposed to decide which ones people should have.*

If someone cannot in good conscience do parts of a job, then yes, he should find a different one. A sporting goods store owner can certainly decide not to carry guns, but if he does carry them, then selling them is part of the job and a customer should be able to buy any of a store's inventory from whoever is on duty to sell it. Very few of us have the luxury of taking a job and then just doing the parts of it we like. I see no reason to single pharmacists out as an exception.

Dear Dr. Schmidt,

In the November editorial "Diffuse Tyranny," you talk about the subject of pharmacists refusing to fill prescriptions for things like birth control because of their personal moral philosophy.

This is simply debunked since on any job application that I have filled out there is a question with yes and no boxes. It states something like this: "Is there any reason that you would not be able to perform the duties that would be assigned to you in this job? If yes, explain." If a pharmacist answers "no" to that question and then fails to fill out prescriptions for legal substances, they should be fired or disciplined. If a pharmacist answers "yes," a pharmacy may still hire them after an explanation, but the pharmacy should keep pharmacists on staff that will fill those prescriptions.

Businesses are in business to make money. Pharmacists have the choice of career field. If they choose to be a pharmacist without the dedication to the patient to fill their needs, it is negligent and can be harmful to their patients. Some medications require women to be on birth control for simple maladies like acne.

The pharmacist that chooses not to fill birth control medicine prescriptions not only endangers the life of women, but also should take responsibility for any pregnancies that are incurred by people that should not be pregnant and take care of the malformed children that result from medications that affect childbirth. The pharmacist should have to sit with any woman that experiences a miscarriage because the medicine they are taking increases the chances of miscarriages and tell them exactly why they are having a miscarriage and how it is for the moral good.

Alexander Flynn ■

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UPCOMING EVENTS Anthony Lewis

13–15 January 2006
ARISIA (New England Speculative Media conference) at Boston Park Plaza Hotel, Boston, MA. Guest of Honor: Allen Steele; Artist Guest of Honor: John Howe; Fan Guest of Honor: Barb Schofield. Registration: $40 at the door ($20 Friday, $35 Saturday, $20 Sunday). Info: www.arisia.org; info@arisia.org; Arisia, Building 600, PMB 322, 1 Kendall, Cambridge, MA 02139.

20–22 January 2006
COSINE (Colorado-area SF conference) at Colorado Springs, Colorado. Guests of Honor: Sharon Lee & Steve Miller. Info: http://www.stardel.com/cosine/index.html; COSine, Box 50618, Colorado Springs, CO 80949-0618. [Note: may be held 13-15 January—check the website]

27–29 January 2006
VERICON VI (Harvard multi-media conference) at Harvard Yard, Cambridge, MA. Guest of Honor: George R. R. Martin. Info: www.vericon.org; conchair@vericon.org; Vericon VI, c/o 4 University Hall, Harvard University, Cambridge, MA 02138

17–19 February 2006
BOSKONE 43 (New England SF conference) at Boston Sheraton, Boston, MA. Guest of Honor: Ken MacLeod; Official Artist: Donato Giancola; Special Guest: Cory Doctorow; Featured Filker: Steve Macdonald. Registration: $43 until 16 January 2006. Info: www.nesfa.org/boskone/; b43info@boskone.org; Boskone 43, Box 809, Framingham, MA 01701; Fax: (617) 776-3243.

24–26 February 2006
SHEVACON 14 (Shenandoah Valley SF conference) Writer Guest of Honor: Catherine Asaro; Artist Guest of Honor: Joe DeVito. Info: http://www.shevacon.org/; registration@shevacon.org; SheVaCon, P.O. Box 416, Verona, VA 24482-0416.

23–27 August 2006
L.A.CON IV (64th World Science Fiction Convention) at Hilton Anaheim, Anaheim Marriott, Anaheim Convention Center, Anaheim, CA. Guest of Honor: Connie Willis. Artist Guest of Honor: James Gurney. Fan Guest of Honor: Howard DeVore. Special Guest: Frankie Thomas (Tom Corbett, Space Cadet). Registration: $150 / C$195 / €125 / £72 until 14 September 2005. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: www.laconiv.org; info@laconiv.org. L.A.con IV, c/o S.C.I.F.I., Inc., Box 8442, Van Nuys CA 91409. International Agents: Canada: Lloyd & Yvonne Penney, 1706-24 Eva Road, Etobicoke, ON M9C 2B2, Canada (Canadian cheques to Lloyd Penney). UK: John Harold, Robbie Bourget, 8 Warren Close, Langley Slough, Berkshire SL3 7UA, UK (UK/Euro cheques to John Harold). ■

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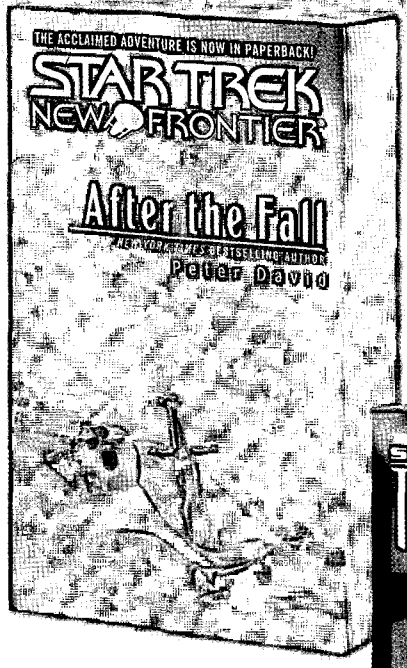

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